NATIONAL LEAD COMPANY

PRODUCTS

NATIONAL LEAD COMPANY

PRODUCTS

for

INDUSTRY and TRADE

CATALOG NO. 47J

MEMBER OF

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CONTENTS

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The common metal . . . L E

Lead is as old as the hills and, as a metal, has been known and used by man for thousands of years. The alchemists of the Middle Ages considered lead the oldest metal and gave it the name of the father of the gods, Saturn. Thus it bears the sign of Saturn ♄.

Lead is found in the earth's crust in many parts of the world. It occurs most commonly as the mineral galena, the natural sulphide of lead. Principal lead producers are the United States, Europe, Australia, Canada and Mexico. In this country, the state of Missouri is the main source of lead, followed by Idaho and Utah.

After the ore has been mined, it is crushed into fine particles which are put through a separating and concentrating process which rids the ore of the unwanted parts, usually called "tailings." Then the lead "concentrates" are smelted—an operation in which the concentrates, generally in the form of lead sulphide, are reduced to metallic lead. Impurities that remain are removed by refining processes.

The impurities often associated with lead concentrates are silver, copper, zinc, antimony, bismuth, iron and several other metals. So thorough is the refining process for lead used for certain purposes (i.e. corroding) that the metal may assay 99.995 per cent pure. Chemical lead usually is 99.90 to 99.92 and common lead from 99.73 to 99.93 per cent pure.

After the refining process, the molten lead is cast into pigs and shipped to the manufacturers of lead products, among whom the makers of storage batteries, cable coverings, paint pigments, Ethyl gasoline, ammunition, lead sheet and pipe, foil and insecticides are the largest consumers.

Left: *Scene in a St. Joseph Lead Co. mine in southeast Missouri. An idea of the size of the opening may be obtained by noting the tiny figure of a miner near the upper left corner.* Below: *A one-pound specimen of galena—lead-bearing mineral. The picture is life size.*

A D . . . with uncommon properties

Lead is heavy. A cubic foot of cast pure lead weighs 707 pounds. Because it concentrates great weight in small volume, lead is the obvious choice for such articles as sash, counter and dress weights, sinkers, shot and some types of ballast.

Lead is soft. Ordinary soft lead has a Brinell hardness number of 3.2 to 4.5. Because it is soft and inelastic, lead is used in bearing metals, expansion bolt anchors, gaskets, washers, lead wool and caulking.

Lead is pliable. In the form of pipe, tubing, cable covering, sheet and wire it can easily be made to conform to various shapes and contours encountered in excavations, plumbing and piping systems and in roof, ceiling, wall and floor installations. Because it is so easily worked and formed, and because it has no "spring," lead is universally used for the cames with which stained glass windows are made.

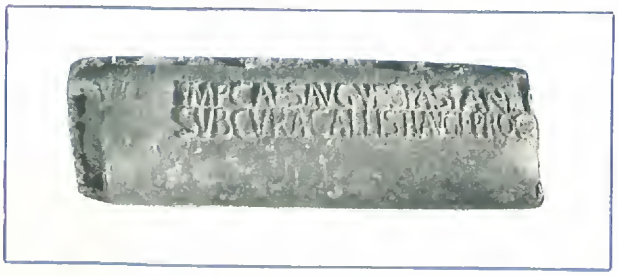
Lead is low-melting. Ordinary lead melts at 621° F. Its low melting point is one of the reasons lead is used in caulking and casting. Lead is combined with one or more other metals to form electric fuses, sprinkler heads and boiler plugs—all requiring low melting points. Many solders and printers' metals, which must be readily meltable to fit them for use, are lead-base alloys.

Lead is "absorbent." Energy, in the form of sound, vibration, radio waves and radium emanations, is absorbed to a considerable degree by lead. Because of this unusual quality, lead is used in doors and partitions of radio studios; for anti-vibration pads under buildings; for protective shielding in X-ray rooms, and where radio-active materials are made or handled.

Lead is corrosion-resistant. Atmosphere, soil, salt water and many chemicals—all corrosive by nature—have little effect upon lead. Because of its high resistance to corrosion, in combination with other attributes, lead is used for roofing, ornamental work, flashings, water service pipe, chemical equipment, overhead and underground cable sheathing, and in numerous other installations subject to attack by corrosive elements. Lead and certain lead compounds exhibit a property which may be called electro-chemical reversibility. To this property we attribute the efficiency of the modern lead-acid storage battery.

Lead is durable. It is the most durable of the common metals. In fact, lead is used instead of other materials for many architectural and industrial purposes largely because it lasts.

Right: *Pouring molten lead in a smelter.* Below: *This section of lead pipe, 17" long and 5" wide, weighing 29 pounds, was dug up in Rome in 1907. It had been part of a "plumbing" system installed about the year 75 A.D. It has undergone practically no change whatever in nearly 2000 years. The embossed lettering on this pipe, when expanded and translated reads: "(Manufacture of the) Emperor Caesar Augustus Vespasian, under the charge of Callistus, freedman of the emperor, manager."*



A BACKGROUND FOR SERVICE

A length of lead pipe is a prosaic thing. There is no glamour in it—or in almost any other lead product. Lead pipe or sheet or fittings are bought, installed—and largely forgotten. They are bought for the service they render, not for the goods themselves. So long as that service is rendered, so long are they out of mind.

Some buyers may specify National lead products simply because they are produced by the world's largest maker of lead goods. Others may purchase National lead products simply because they are the most widely distributed. But most buyers order National lead products because they give the service every buyer has a right to expect in return for his money.

Raw material resources that stretch back to the mines themselves, manufacturing plants that are equipped with proper facilities, manpower that has the necessary know-how—these are major factors in the production of lead goods that give long, honest service.

But that's not the whole story. A highly important, and most interesting, chapter is devoted to research—the unending search for better means, methods and materials, so that National can offer the best possible product for the best possible service at the lowest possible price.

To carry on research it is, of course, necessary to have adequate facilities. These National has. Pages would be required to picture and explain the many machines, implements and instruments with which National research laboratories are equipped. But that wouldn't and couldn't show the vital element that makes research just what the word implies—the restless, inquiring, never-satisfied frame of mind that sets the true researcher apart from the "qualitative-quantitative" laboratory technician.

The men who man the Research Laboratories of National Lead Company believe sincerely what National's customers have found for themselves—that National lead products truly reflect the unparalleled resources and facilities of the Company. But they also believe—and demonstrate—that good lead goods can be made even better.

It is the purpose of this catalog to bring these better lead goods—the products of great resources, extensive facilities, experienced manpower and perfection-seeking research to the earnest attention of the lead goods buyers of the country.

The National Lead Company line of metal products is so diversified and contains so many highly specialized items that, on numerous occasions, customers and the Company have found it mutually advantageous to discuss problems involving the use of certain metal products before orders are placed or goods shipped. This "meeting-of-minds" policy has, in fact, resulted in the development of new products which filled a need for which no stock or standard item hitherto was available.

GO "NATIONAL" FOR LEAD

With unmatched facilities for the production and distribution of lead goods and related items, it is natural for those who buy or specify these commodities to look first to National Lead Company as a source of supply. Lead-consuming industries and lead-installing trades have, indeed, turned to us so often and in such numbers that National Lead Company has become the nation's lead headquarters.

NATIONAL LEAD COMPANY

GENERAL OFFICES: 111 Broadway, New York 6, N. Y.

BRANCHES, SALES OFFICES AND WAREHOUSES:

Branch	Address	Phone Number
ATLANTIC BRANCH	111 Broadway, New York 6	Rector 2-9400
BALTIMORE BRANCH	214 W. Henrietta Street, Baltimore 3	South 0900
BUFFALO BRANCH	116 Oak Street, Buffalo 3	Cleveland 2262
CHICAGO BRANCH	900 W. 18th Street, Chicago 8	Canal 3700
Detroit, Michigan	1627 West Fort Street, Detroit 16	Cadillac 0309
Milwaukee, Wisconsin	744 No. Fourth Street, Milwaukee 3	Daly 4870
CINCINNATI BRANCH	659 Freeman Avenue, Cincinnati 3	Parkway 7970
Louisville, Kentucky	1320 Heyburn Building, Louisville 2	Jackson 1541
Atlanta, Georgia	Bishop Street, Atlanta	Hemlock 3231
CLEVELAND BRANCH	1213 West Third Street, Cleveland 13	Prospect 4060
PACIFIC COAST BRANCH	2240—24th Street, San Francisco 10	Mission 0440
Los Angeles, California	932 Wilson Street, Los Angeles 21	Trinity 5101
Portland, Oregon	1211 N. W. Glisan Street, Portland 9	Atwater 0254
Seattle, Washington	973 John Street, Seattle 9	Eliot 8130
Spokane, Washington	N. 908 Howard Street, Spokane 11	Broadway 1185
ST. LOUIS BRANCH	722 Chestnut Street, St. Louis 1	Chestnut 8785
Dallas, Texas	959 Terminal Street, Dallas 2	Riverside 8336
Kansas City, Missouri	1406 W. Thirteenth Street, Kansas City 7	Victor 0507
New Orleans, Louisiana	516 Tchoupitoulas Street, New Orleans 12	Raymond 4990
Omaha, Nebraska	2810 A Street, Omaha 7	Jackson 4404
St. Paul, Minnesota	102 West Fairfield Avenue, St. Paul 1	Garfield 6345
JOHN T. LEWIS & BROS. CO.	2545 Aramingo Avenue, Philadelphia 25	Regent 9-7484
NATIONAL LEAD CO. OF PENNA.	1376 River Avenue, Pittsburgh 30	Fairfax 2335
NATIONAL LEAD CO. OF MASS.	800 Albany Street, Boston 6	Garrison 1000
MORRIS P. KIRK & SON, Inc.	2717 S. Indiana Street, Los Angeles 23	Angelus 2-1101

NATIONAL LEAD CO. OF ARGENTINA, S. A. . . . . Buenos Aires
HOYT METAL COMPANY OF GREAT BRITAIN, Ltd. . London, England
THE CANADA METAL CO., Ltd. Toronto, Winnipeg, Montreal, Vancouver

All prices listed in this catalog are subject to change without notice. The information contained in this book is believed to be accurate, but National Lead Company disclaims responsibility for errors.

THE DUTCH BOY TRADE-MARK

(Registered in U.S. Pat. Off.)

The original portrait of the Dutch Boy, reproduced above, was painted in 1907 by Lawrence Carmichael Earle. Mr. Earle, who died in 1921, was a distinguished portrait and character painter. His Dutch Boy is admired by art critics as a boy portrait of unusual merit.

To the American buying public, the Dutch Boy is a familiar figure. He appears in the national advertising and on many of the products of National Lead Company . . . a symbol of quality and reliability.

LEAD PIPE

for handling corrosive chemicals

Lead piping is standard equipment in industrial plants where the manufacturing process involves the use of corrosive chemicals or gases. Typical large users are the oil refineries, metal refineries, acid plants, chemical companies, pulp and paper mills, rayon plants and the like.

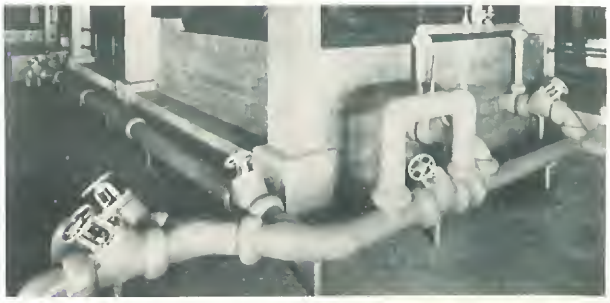
The special property of lead pipe which makes it virtually indispensable in industrial equipment is corrosion resistance. Its outstanding use, because of this property, is in the manufacture and transportation of sulphuric acid. However, lead pipe has been and is being used successfully to handle a large number of other industrial chemicals and gases, often under severe service and temperature conditions.

In addition to corrosion resistance, the pliability of lead pipe is an advantage in chemical equipment. It allows easy-working, such as bending, and the fabrication of the pipe into coils or other special apparatus.

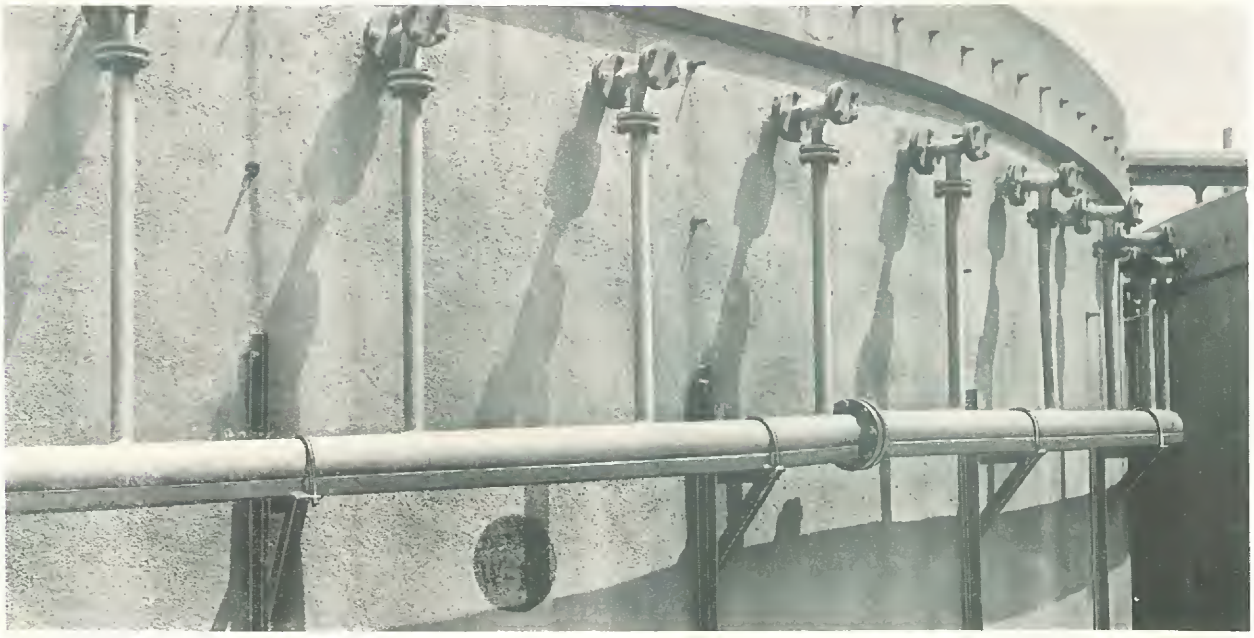
Since the cost of extruding lead pipe is not high, a major portion of the initial cost is for the metal itself. Thus discarded lead piping has a high scrap value, an economy factor which should not be overlooked when purchasing pipe.

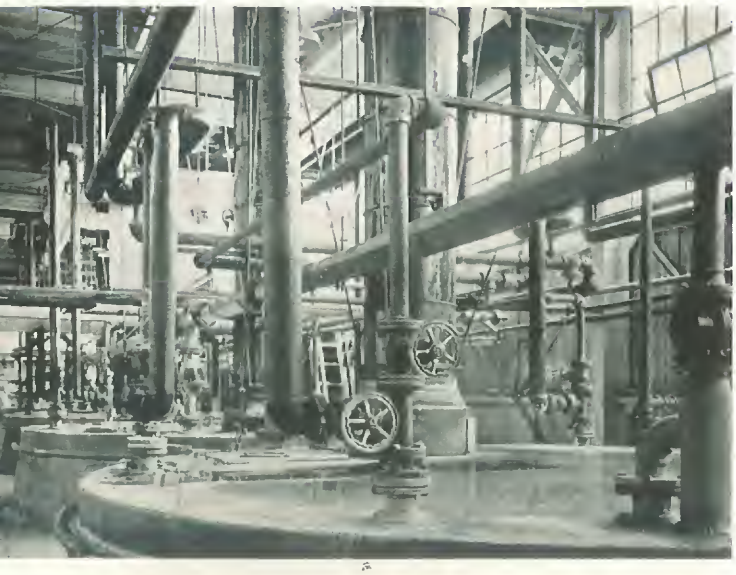
GRADES OF LEAD PIPE

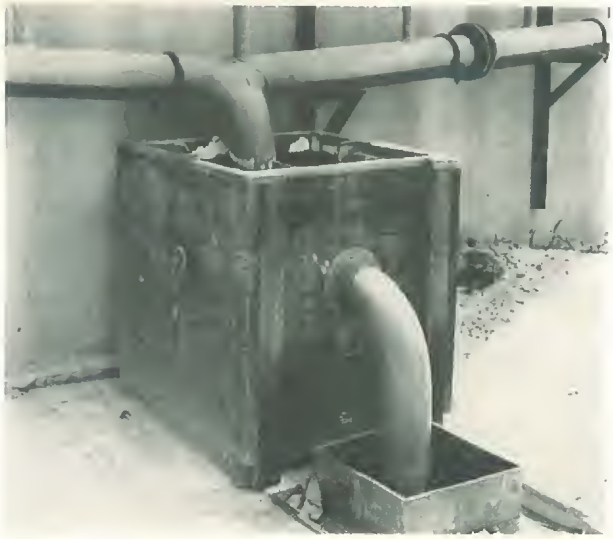
Several types of lead pipe are available for industrial use. All are made either of chemical lead or of chemical lead to which small amounts

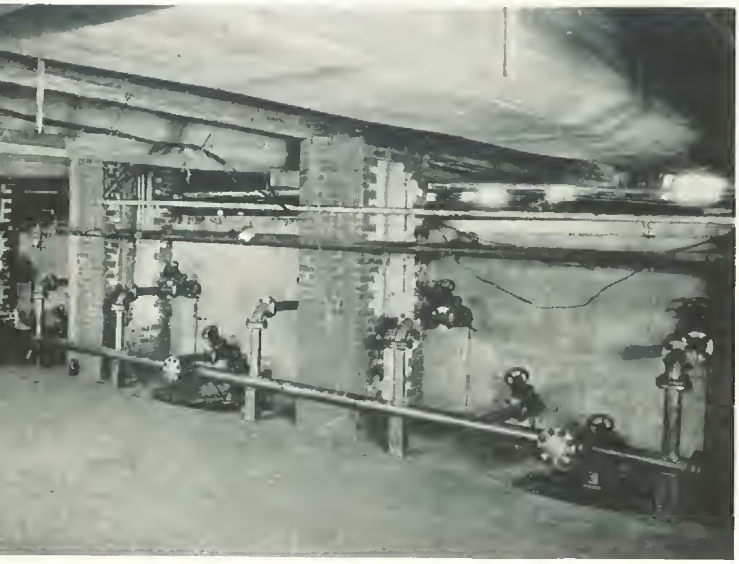


Above: *Lead pipe line for handling a salt solution. Pipes are insulated to facilitate temperature control.* Below: *Discharge pipe on the outside of a circular concrete settling tank.*









of other metals have been added to induce hardness, higher acid-resistance under certain conditions, or some other desirable property. The term "chemical lead" refers to a grade of undesilverized lead containing small amounts of copper and silver which practical experience has shown possesses unusual anti-corrosive properties.

The various types of lead pipe available differ greatly in mechanical strength, resistance to corrosion and other physical properties. If there is no previous service record to guide the selection for a particular installation, the industrial engineer should first determine, by means of tests or by consultation with the technical staff of National Lead Company, the most suitable type to use.

TELLURIUM LEAD PIPE*

This grade of pipe is made from prime chemical lead to which a small quantity of tellurium has been added. The addition is in the amount indicated by our extensive research on this alloy.

Lead containing tellurium has several outstanding properties. One is an improved corrosion resistance, particularly at the higher temperatures. Another is the capacity to work-harden. Tellurium lead—toughened by bending, stretching or hammering—actually has a greater tensile strength than before. Still a third property is a greatly improved resistance to failure under vibratory stresses.

Tellurium lead pipe installations are successfully cutting costs in many industrial and chemical plants. A plating concern recently reported that heating coils fabricated from tellurium lead lasted 100 per cent longer than the coils used previously. A chemical concern reported that a tellurium lead pipe line carrying alum liquor at 90°C. had performed satisfactorily for three years, whereas the type of pipe formerly used twisted and bulged after three months' service.

*Pat. No. 2,060,534

Top: *Lead piping in connection with a battery of digestors in a large industrial plant.* Center: *Another view of the lead discharge pipe shown on the preceding page. The solution empties into a drain protected with sheet lead.* Bottom: *Lead pipe line connecting a series of lead-lined acid mixing and storage tanks.*

TELLURIUM-ANTIMONIAL LEAD PIPE

Tellurium lead pipe is also available alloyed with any specified antimonial content. As with straight antimonial lead pipe, the standard is 6 per cent, and this alloy will be supplied unless otherwise specified.

OTHER GRADES

Chemical Lead Pipe: Chemical lead pipe is made only from standard accepted brands of prime lead which conform to Grade II of the A. S. T. M. standard specifications (B29-35).

Antimonial Lead Pipe: Antimonial lead pipe is made from prime chemical lead, alloyed with any specified antimony content up to 10 per cent. Most pipe of this grade contains 6 per cent antimony which is standard in many plants.

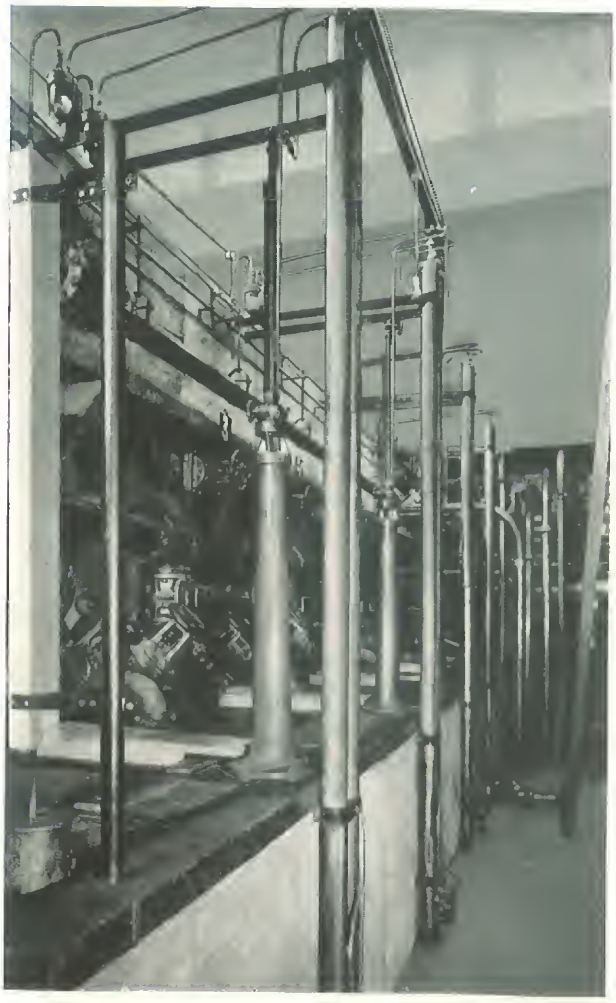
Tin-Lined Lead Pipe: This pipe is made from pure chemical lead with an adherent tin lining. Stock sizes are ⅜" I.D. (10 ozs. per foot) and ½" I.D. (12 ozs. per foot). Other sizes can be made quickly on order.

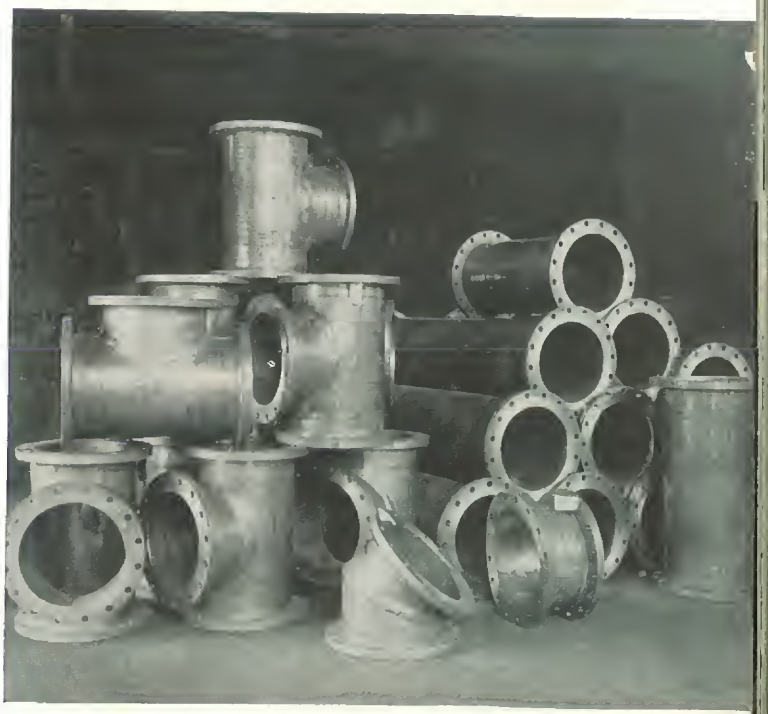
SIZES AND WEIGHTS

Lead pipe, manufactured by National Lead Company, is made in a wide range of sizes and weights to fit every industrial need. A list of many commonly used sizes and weights is given on pages AA-5 and AA-6.

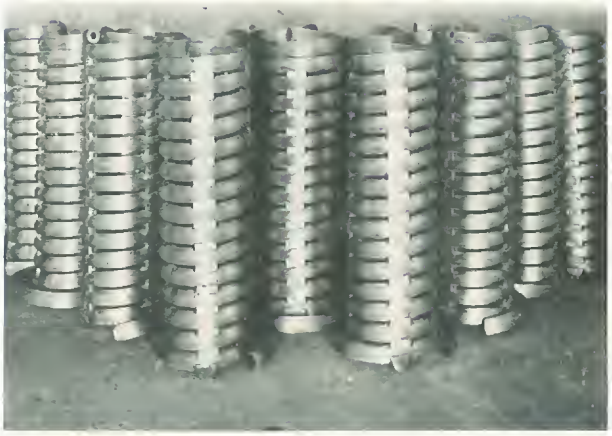
PACKING

Every precaution is taken to wrap and pack our lead pipe properly to protect it for handling and shipment to the consumer. The method and manner of packing and the protective coverings used depend, of course, upon the materials available at time and place of shipment. Certain types and sizes of pipe are shipped in coils or on reels, others in standard lengths, unless otherwise specified.



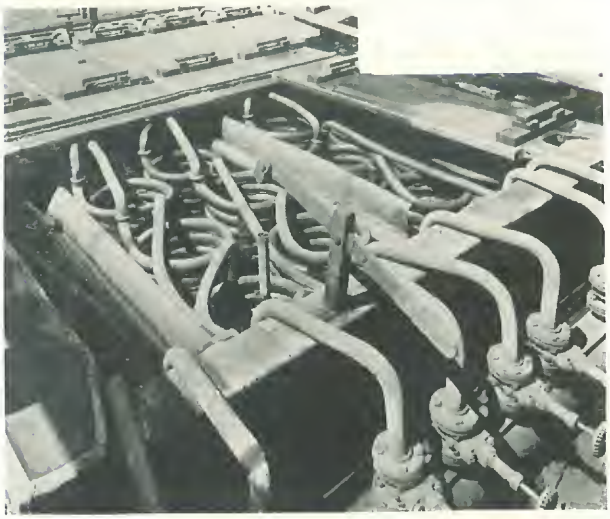


Top: *A battery of lead-lined acid mixing tanks, together with the lead piping and lead-lined valves necessary to supply the system.* Bottom: *Six per cent antimonial flanged pipe and fittings fabricated at one of our plants for a southern paper company. The total shipment weighed more than 26 tons.*



Above: *A group of special corrugated lead pipe coils. Corrugations increase the heating surface.* Below: *Lead cooling coils in an acid plant.*

LEAD PIPE COILS



Special helical lead coils coupled for testing.

Lead bends can be supplied in any desired size from 1¼″ I.D. up to and including 6″ I.D. Traps are furnished in all standard patterns.

We can also supply extruded chemical lead bends. The following list prices and cut dimensions are for the standard 90° bend but we can furnish any shape bend and any length required.

(Prices subject to change without notice.)

Inside Diameter	Wall Thickness	Cut Dimensions	List Prices
3″	¼″	5½″ x 5½″	$6.00
4″	9/32″	6½″ x 6½″	8.00
5″	11/32″	7½″ x 7½″	10.50
6″	⅜″	8″ x 8″	13.00

Where an oversize bend is wanted, for each inch or fraction thereof of excess length over listed size, the increase in price is as follows:

For 3″ diameter . . . . .54 cents per inch or fraction
" 4″ " . . . . .62 " " " " "
" 5″ " . . . . .70 " " " " "
" 6″ " . . . . .78 " " " " "

SPECIALTIES

Special Lead Pipe: Lead pipe of special composition or shape can be supplied on short notice. This includes such pipe as that used in chromium plating equipment or elliptical pipe used for cooling gases where a large surface area to a small volume of pipe is desired.

Flanged Pipe & Fittings: Flanged antimonial lead pipe, flanged lead headers, ells, bends and similar pipe fittings are supplied on customer's specification.

Lead Traps and Bends: We manufacture a full line of lead traps and bends for the chemical industry as well as for water service and plumbing.

Lead Pipe Coils: We fabricate lead pipe coils of any size and of any composition desired. In ordering, the best plan is to submit a blueprint. Specify center-to-center dimensions, number of turns, spacing between turns and position and length of inlet and outlet.

Lead Spacer Blocks: For pipe coils erected in the field, it is a good plan to use fabricated lead spacer blocks or coil supports. We manufacture lead spacer blocks in a wide range of sizes, compositions and shapes. Special types can be furnished at extra costs to include making of new dies.

LEAD PIPE SIZES AND WEIGHTS

The sizes and weights given in this table are those used frequently in the chemical trade. In most cases the dimensions differ from similarly classified pipe used for water service and plumbing. Lead pipe in other sizes and weights can be furnished on short notice.

NOMINAL SIZE INSIDE DIAMETER	CLASSIFICATION EAST	CLASSIFICATION WEST	NOMINAL SIZE OUTSIDE DIAMETER	NOMINAL WALL THICKNESS	NOMINAL WEIGHT PER FOOT
Inches			Inches	Inch	Pounds
3/8"	E	AQ	.481	.053	.35
	D	XL	.531	.078	.55
	C	L	.561	.093	.67
	B	M	.601	.113	.85
	A	S	.661	.143	1.14
	AA	XS	.721	.173	1.46
	AAA	XXS	.741	.183	1.58
	Spec.		.761	.193	1.69
	Spec.		.801	.213	1.93
1/2"	E	AQ	.64	.070	.62
	D	XL	.68	.090	.82
	C	L	.72	.110	1.04
	B	M	.73	.115	1.09
	Spec.		.80	.150	1.51
	A	S	.84	.170	1.76
	AA	XS	.88	.190	2.03
	Spec.		.96	.230	2.59
	AAA	XXS	1.04	.270	3.21
5/8"	E	AQ	.77	.073	.79
	D	XL	.81	.093	1.03
	C	L	.88	.128	1.49
	B	M	.96	.168	2.06
	Spec.		.98	.178	2.21
	A	S	1.02	.198	2.52
	AA	XS	1.06	.218	2.84
	Spec.		1.08	.228	3.00
	AAA	XXS	1.14	.258	3.51
3/4"	E	AQ	.88	.065	.82
	D	XL	.94	.095	1.24
	C	L	1.00	.125	1.69
	Spec.		1.03	.140	1.92
	B	M	1.07	.160	2.24
	Spec.		1.10	.175	2.50
	A	S	1.14	.195	2.84
	AA	XS	1.21	.230	3.48
	Spec.		1.27	.260	4.06
	AAA	XXS	1.34	.295	4.76
7/8"			1.00	.062	.91
			1.12	.123	1.89
1"	E	AQ	1.20	.100	1.70
	D	XL	1.23	.115	1.98
	C	L	1.27	.135	2.36
	B	M	1.35	.175	3.17
	A	S	1.42	.210	3.92
	AA	XS	1.48	.240	4.59
	AAA	XXS	1.59	.295	5.90
1 1/4"	E	AQ	1.44	.095	1.97
	D	XL	1.49	.120	2.54
	C	L	1.53	.140	3.00
	B	M	1.59	.170	3.73
	A	S	1.67	.210	4.73
	AA	XS	1.74	.245	5.65
	AAA	XXS	1.84	.295	7.04
1 1/2"	E	AQ	1.74	.120	3.00
	D	XL	1.78	.140	3.54
	C	L	1.83	.165	4.24
	B	M	1.87	.185	4.81
	A	S	1.98	.240	6.45
	AA	XS	2.04	.270	7.38
	Spec.		2.07	.285	7.85
	AAA	XXS	2.12	.310	8.66
1 3/4"	D	XL	2.00	.125	3.62
	C	L	2.06	.155	4.55
	B	M	2.12	.185	5.52
	Spec.		2.15	.200	6.02
	A	S	2.18	.215	6.52
	AA	XS	2.31	.280	8.77
	AAA	XXS	2.50	.375	12.31
2"	E	AQ	2.18	.090	2.90
	Spec.		2.24	.120	3.92
	D	XL	2.27	.135	4.44
	Spec.		2.31	.155	5.15
	C	L	2.34	.170	5.69
	B	M	2.38	.190	6.42
	A	S	2.48	.240	8.30
	Spec.		2.50	.250	8.69
	AA	XS	2.51	.255	8.87
	AAA	XXS	2.71	.355	12.91
2 1/2"			2.66	.080	3.17
			2.67	.085	3.38
			2.75	.125	5.07
			2.80	.150	6.13
			2.87	.185	7.66
			3.00	.250	10.62
			3.12	.310	13.44
			3.25	.375	16.66
			3.375	.437	19.81
			3.50	.500	23.19
3"			3.10	.050	2.34
			3.18	.090	4.28
			3.19	.095	4.52
			3.24	.120	5.76
			3.25	.125	6.04
			3.34	.170	8.30
			3.37	.185	9.08
			3.50	.250	12.56
			3.62	.310	15.83
			3.75	.375	19.57
			3.875	.437	23.25
			4.00	.500	27.05
3 1/2"			3.665	.082	4.71
			3.68	.090	4.96
			3.71	.105	5.82
			3.75	.125	7.00
			3.87	.185	10.50
			4.00	.250	14.49
			4.12	.310	18.42
			4.25	.375	22.46
			4.37	.435	26.63
			4.50	.500	30.91

LEAD PIPE SIZES AND WEIGHTS (Continued)

NOMINAL SIZE INSIDE DIAMETER	NOMINAL SIZE OUTSIDE DIAMETER	NOMINAL WALL THICKNESS	NOMINAL WEIGHT PER FOOT
Inches	Inches	Inch	Pounds
4″	4.18	.090	5.64
	4.20	.100	6.30
	4.25	.125	7.97
	4.30	.150	9.67
	4.37	.185	11.99
	4.50	.250	16.42
	4.65	.325	21.68
	4.75	.375	25.36
	4.84	.420	28.64
	5.00	.500	34.78
4½″	4.71	.105	7.43
	4.75	.125	8.94
	4.81	.155	11.10
	4.87	.185	13.35
	5.00	.250	18.36
	5.11	.305	22.60
	5.25	.375	28.26
	5.375	.437	33.29
	5.50	.500	38.64
5″	5.10	.050	3.85
	5.25	.125	9.90
	5.31	.155	12.29
	5.37	.185	14.77
	5.50	.250	20.29
	5.62	.310	25.38
	5.75	.375	31.15
	5.87	.435	36.47
	6.00	.500	42.50
5½″	5.66	.080	6.83
	5.75	.125	10.87
	5.87	.185	16.18
	6.00	.250	22.22
	6.12	.310	27.76
	6.25	.375	34.06
	6.37	.435	39.82
	6.50	.500	46.37
6″	6.25	.125	11.84
	6.37	.185	17.60
	6.50	.250	24.15
	6.62	.310	30.14
	6.75	.375	36.95
	6.87	.435	43.17
	7.00	.500	50.24
6½″	6.75	.125	12.80
	6.87	.185	19.02
	7.00	.250	26.09
	7.125	.312	32.75
	7.25	.375	39.85
	7.375	.437	46.75
	7.50	.500	54.10
7″	7.25	.125	13.76
	7.37	.185	20.43
	7.50	.250	28.01
	7.625	.312	35.14
	7.75	.375	42.74
	7.87	.435	49.86
	8.00	.500	57.96
7½″	7.75	.125	14.73
	7.87	.185	21.84
	8.00	.250	29.95
	8.12	.310	37.29
	8.25	.375	45.64
	8.37	.435	53.20
	8.50	.500	61.82
8″	8.25	.125	15.69
	8.37	.185	23.26
	8.50	.250	31.88
	8.62	.310	39.67
	8.75	.375	48.54
	9.00	.500	65.69
8½″	8.75	.125	16.66
	9.00	.250	33.81
	9.12	.310	42.05
	9.37	.435	59.90
	9.50	.500	69.55
9″	9.37	.185	26.09
	9.50	.250	35.74
	9.62	.310	44.43
	9.75	.375	54.34
	10.00	.500	73.42
9½″	9.75	.125	18.60
	9.87	.185	27.50
	10.00	.250	37.68
	10.25	.375	57.24
	10.37	.435	66.58
	10.50	.500	77.28
10″	10.25	.125	19.56
	10.37	.185	28.89
	10.50	.250	39.61
	10.62	.310	49.16
	10.75	.375	60.14
	10.87	.435	69.90
	11.00	.500	81.15
11″	11.50	.250	43.47
	12.00	.500	88.89
12″	12.37	.185	34.49
	12.50	.250	47.33
	12.62	.310	58.60
	12.75	.375	71.73
	13.00	.500	96.58

SHEET LEAD

Sheet lead is produced by rolling or milling. Its manufacture involves first the casting of large slabs, several inches thick, from pigs of pure lead or a desired lead alloy. These slabs are then rolled, either hot or cold depending upon the composition of the lead, between steel rollers to a specified thickness.

For many years, we have been the nation's leading supplier of high quality sheet lead. Our product is made only from standard accepted brands of prime lead and lead alloys. Every precaution is taken to produce sheet that is precisely as specified with respect to thickness or weight, subject to commercial tolerances.

SIZES AND WEIGHTS

The standard size for milled sheet lead, weighing three pounds per square foot or over, is 8′ wide by 20′ long. The standard size for sheet lead weighing less than three pounds per square foot is 4′ to 5′ wide by 15′ long. However, we are able to furnish sheets on short notice which are considerably larger in width and length than these standard sizes. The maximum sizes are given in the table on the following page.

Sheet lead may be specified either by its weight per square foot or its thickness. There is a rough mathematical correlation between the two. Pure lead sheet weighing one pound per square foot is 1/64″ thick. Except in the larger sizes, each additional pound per square foot adds 1/64″ to the thickness.

Commonly used weights of sheet lead are shown in the table on the next page. Other weights per square foot can be rolled on short notice.

DIRECTIONS FOR ORDERING

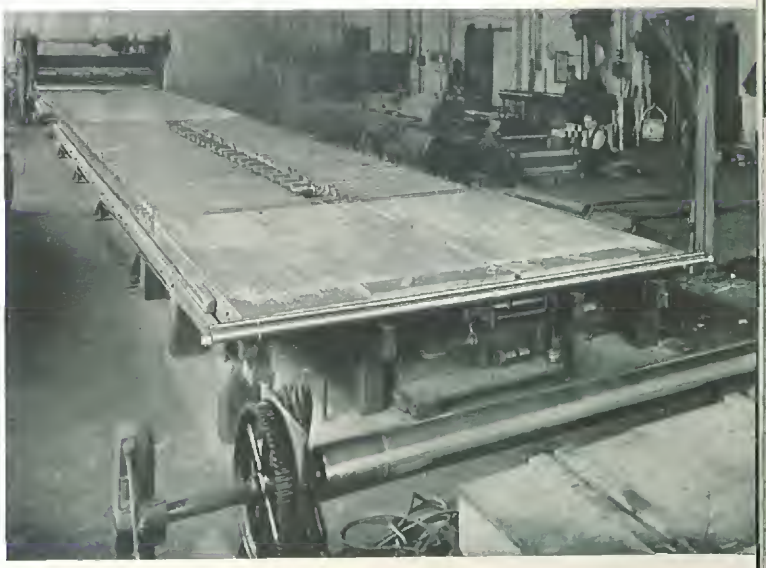
In ordering sheet lead, specify the type of lead wanted, the weight per square foot or the thickness and the number and size of the sheets. In ordering sheet lead in other than regular stock sizes, please note the following instructions:

Our care in manufacture insures sheet lead of accurate thickness and weight.

If plain rectangular sheets are wanted, state clearly the width and length. In the case of irregular shape sheets, forward a sketch giving dimensions or send a drawing of the object to be lined or covered, stating clearly all dimensions.

PACKING

Unless otherwise specified, all sheet lead is shipped in rolls which are carefully packed in wooden slats or double-faced corrugated board and fastened with steel straps, wire or rope.



View of a sheet lead rolling mill showing rollers which propel the lead, and cutting table in foreground.

SHEET LEAD SIZES AND WEIGHTS

The weights given below apply to common lead only. Other types of lead, such as antimonial or hard lead, weigh slightly less for a given thickness.

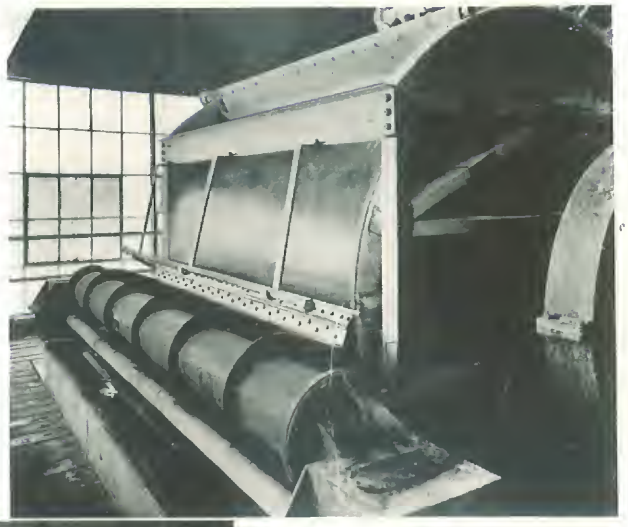
Pounds Per Sq. Ft.	Actual Thickness	App. Thickness in Inches		Maximum Sizes
		Decimal	Fraction	
¾		.0117	1/80	4′x15′
1		.0156	1/64	8′x20′
1½		.0234	3/128	8′x20′
2		.0312	1/32	7′x45′
2½		.0391	5/128	9′x45
3		.0468	3/64	10′x45
3½		.0547	7/128	10′x45′
4		.0625	1/16	10′x45
5		.0781	5/64	10′x43′
6		.0937	3/32	10′x43′, 11′x40′ 11′6″x30′, 11′9″x20
8		.1250	1/8	10′x40′ 11′6″x35′
10		.1563	5/32	11′x40′ 10′x48′
12		.1875	3/16	11′6″x40′ 11′x40′ 11′6″x35′
14		.2188	7/32	11′6″x40′ 11′9″x30′
16		.2500	1/4	11′6″x40′ 11′9″x30′
20		.3333	1/3	11′6″x40′ 11′9″x38′
24		.4000	2/5	11′9″x30′ 11′x34′ 11′6″x32′
30		.5000	1/2	11′x27 11′6″x25′6″ 12′x16′
40		.6667	2/3	11′x24 12′x16
60		1.0000	1″	12′x12′

SHEET LEAD

for handling corrosive chemicals

Because of its high corrosion resistance, sheet lead is virtually a standard material for the lining of vats, tanks, agitators and similar types of equipment in chemical and industrial plants. It is also employed extensively as a protective covering for apparatus subjected to corrosive fumes or acid splash.

Sheet lead has been used successfully with a wide variety of acids and chemicals. Of special interest is its service record in the concentration and handling of sulphuric, phosphoric and hydrofluoric acids, for handling sulphite solutions in the paper industry and for sulphonation and chlorination processes in the organic chemicals industry.



Above: *Lead covered drum-type acid filter in a pigment manufacturing plant. The trough in the foreground is also formed from sheet lead. The revolving drum is made of perforated lead.*

Left: *Sheet lead lining being installed in a circular concrete settling tank. Note the vertical steel straps which support the lining. These straps are later covered with strips of lead. One strap has already been covered.*

Below: *Dehydrator stack connections in an acid plant. These flues, formed from sheet lead, carry steam containing sulphuric acid.*

In addition to corrosion resistance, sheet lead has other desirable properties which adapt it to industrial use. Being pliable and malleable, it is easily worked and can be readily shaped to conform to the interiors or exteriors of chemical apparatus. The low melting point of lead facilitates the "burning" of sheets to form continuous corrosion resistant surfaces. Finally, sheet lead's rela-

tively low initial cost and high salvage value make it more economical than many other materials that are sometimes used.

GRADES OF SHEET LEAD

For construction purposes in chemical and industrial plants, we manufacture sheet lead of several different types. The standard grades furnished are chemical lead, tellurium lead, tellurium-antimonial lead, antimonial lead, and crawlproof lead, a reinforced chemical lead. Descriptions of these grades are given on the pages that follow.

Occasionally, sheet lead of a special composition is required for certain types of equipment. We are in a position to furnish these special leads, according to specification, on short notice.

SELECTION OF SHEET LEAD

The various grades of sheet lead differ more or less widely in mechanical strength and corrosion resistance under a given set of conditions. If there is no previous service record to guide the selection of sheet lead for a particular installation, the industrial engineer should first determine, by means of actual plant tests or by consultation with the technical staff of National Lead Company, the grade which will best serve his purpose.

CHEMICAL LEAD SHEET

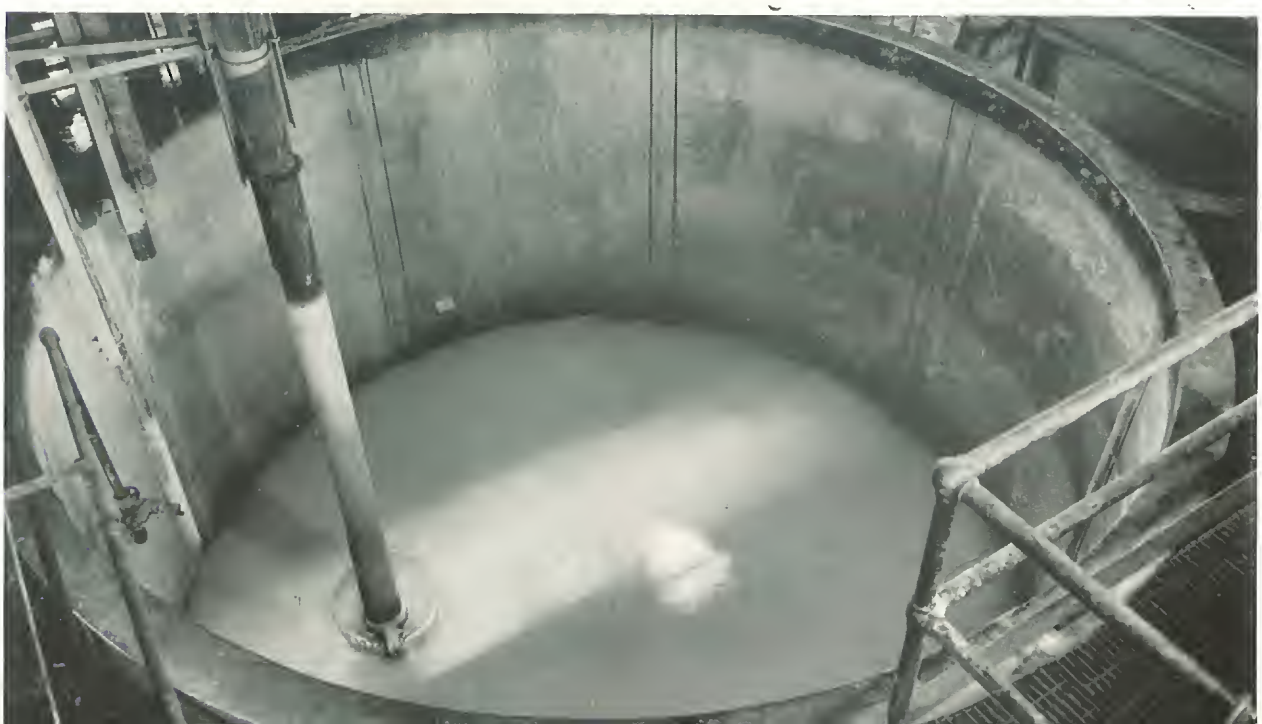
Chemical lead sheet is rolled from "chemical lead," a term used in the trade to designate a type of lead produced from southeast Missouri ores.

Chemical lead is a practically pure lead, free from bismuth and characterized by the presence of about .06% copper. The copper is advantageous in several respects: it increases the normal corrosion resistance of lead; raises its recrystallization temperature, thus retarding grain growth; and gives lead a greater tensile strength and higher endurance limit or fatigue strength.

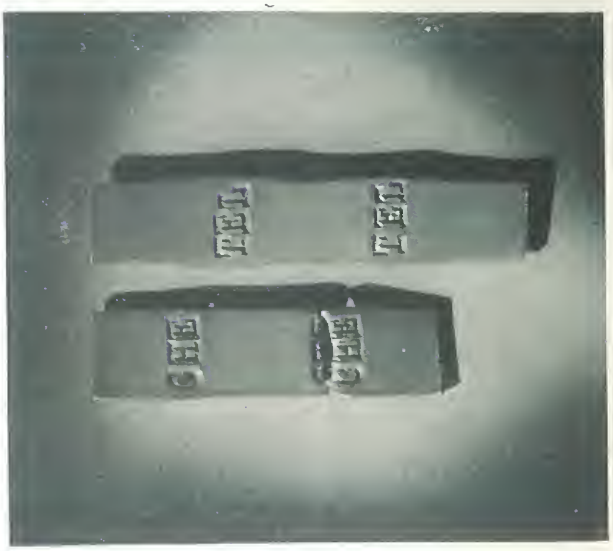
Chemical lead has been used successfully in the chemical industry for more than a generation. It may properly be called the base lead for acid-handling purposes since virtually all other grades intended for industrial use are simply chemical lead, alloyed with varying quantities of other metals.

Our chemical lead sheet is rolled only from standard accepted brands of prime lead which conform to Grade II of the A.S.T.M. standard specifications (B29-35). It is furnished in any gauge from $\frac{1}{64}$" up.

Large lead-lined mixing tank. Inlet and outlet connections are also of lead.



Strips of lead with and without tellurium content after immersion in 96% sulphuric acid at 305°C. for 3 minutes. Tellurium lead weight loss, 0.97%—other lead 5.11%.



Strips of lead, with and without tellurium content, stamped and then stretched. Stamping strengthened tellurium lead (top) but weakened the other lead.

TELLURIUM LEAD SHEET*

Tellurium lead sheet is rolled from a grade of lead obtained by adding a small quantity of tellurium (less than 0.1%) to primary chemical lead.

One outstanding feature resulting from the addition of tellurium is improved corrosion resistance—particularly under conditions where corrosion is most severe—at high temperatures, when vibration or mechanical strain is also present. In a flash test, specimens of tellurium lead and lead without tellurium were held at 305°C. in 96% sulphuric acid for three minutes. The lead containing tellurium showed a weight loss of only 0.97%; the other lead showed a weight loss of 5.11%.

Another quality which tellurium develops in lead is the capacity to work-harden—to strengthen under strain. Tellurium lead, toughened by mechanical action such as rolling, bending, stretching or hammering, actually has a greater tensile strength and resistance to fracture than before.

Tellurium lead's ability to strengthen itself has been of great practical value in plants where the nature of the operation or the design of the equipment puts an undue burden on the corrosion

*Pat. No. 2,060,534

SERVICE REPORTS ON TELLURIUM LEAD

An Explosives Manufacturer
"Its rate of corrosion is about half that of ordinary lead."

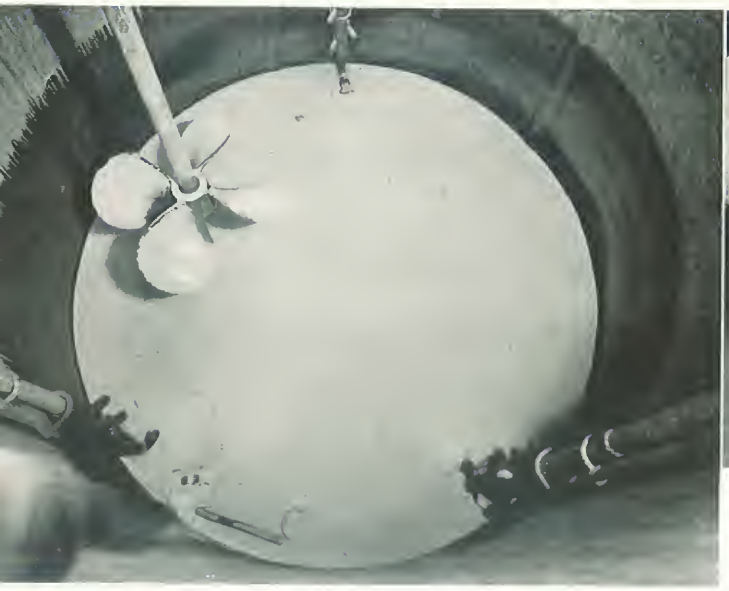
A Chemical Company
"We estimate approximately 25 per cent longer life from tellurium lead as compared to other leads."

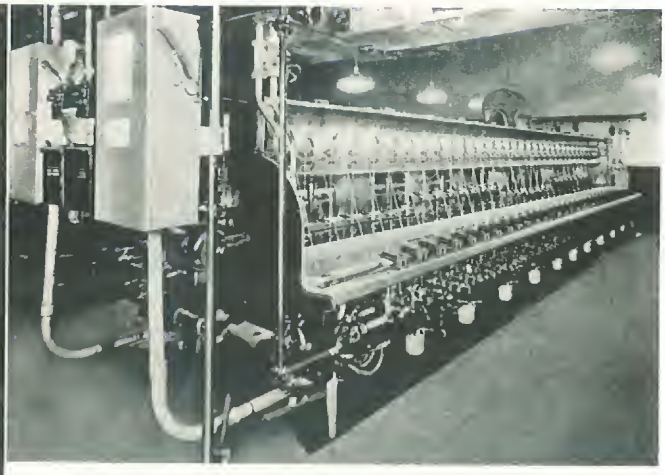
A Soap Manufacturer
"After 8 months' service, the tellurium lead lining in our tub shows no signs of creeping and very little if any corrosion, although subjected to 10 per cent boiling sulphuric acid."

A Rayon Manufacturer
"Our tellurium lead lining—in service two years—still conforms to the tank shape as snugly as on installation. No bulging has occurred."

A Battery Manufacturer
"The 3-year old tellurium lead lining in our large sulphuric acid mixing tank is very smooth and uniform with no sign whatever of buckling, although the tank is used for cutting raw acid. Other linings have given us trouble by buckling and cracking."

A Metal Refinery
"For the last two years, we have purchased all our lead requirements in tellurium lead. We find a considerable advantage in its stiffness and resistance to vibration crystallization."





Tellurium lead's longer life under vibratory stress makes it a suitable material for the linings of mixing tanks (left), for the coverings on rayon spinning machines (above), or for other equipment subject to vibration.

resistant materials used. For example, tellurium lead tends to give longer service when employed as a lining in tanks where frequent and rapid heat changes occur. Movements of the lining due to expansion or contraction toughen the lead at the point of deformation. Subsequent movements due to expansion take place at other points over the lining, lessening the possibility of fatigue fracture.

Still another quality of tellurium lead—due in part to its capacity to work-harden—is a higher endurance limit and therefore a greatly improved resistance to failure under vibratory stresses. Where vibration exists, tellurium lead appears to set up an opposition to the vibration, toughening and strengthening itself to the point where it withstands considerable buckling or creeping.

Tellurium lead in sheet form is available in any gauge from $\frac{1}{64}$" up.

TELLURIUM-ANTIMONIAL LEAD SHEET

Tellurium-antimonial lead sheet is made from tellurium lead, alloyed according to specification with various percentages of antimony. As in the case of straight antimonial lead sheet described in some detail on the opposite page, the antimony content usually specified is 6%.

In general, the addition of antimony to tellurium lead produces the same physical changes as those noted for straight antimonial lead. Harder and stiffer than straight tellurium lead, its better resistance to abrasion makes it suitable for linings subject to considerable erosion.

Tellurium-antimonial lead sheet is furnished in any gauge from $\frac{1}{64}$" up.

Installing a tellurium-antimonial lead lining in an oil refinery agitator. In this particular installation, the depth of the tank and the relatively few supporting straps indicated the use of a sheet lead hardened and stiffened with antimony.

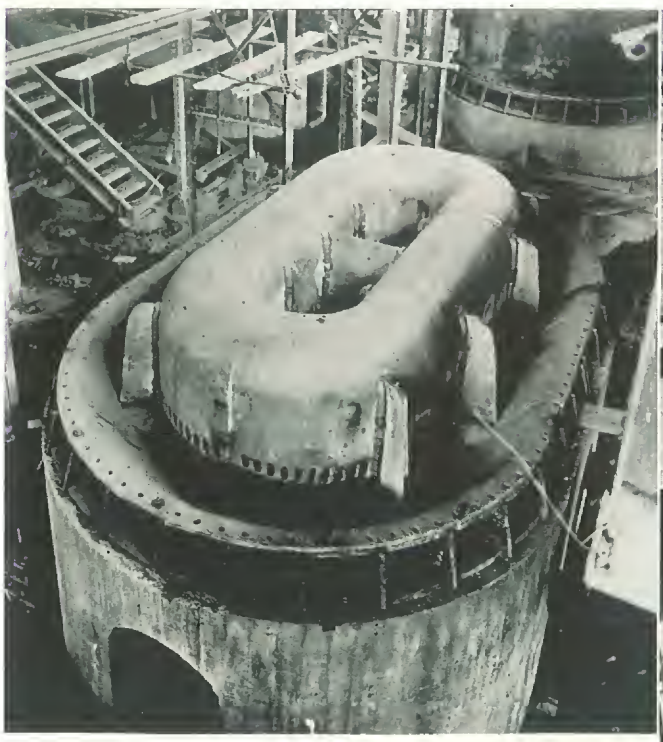
ANTIMONIAL LEAD SHEET

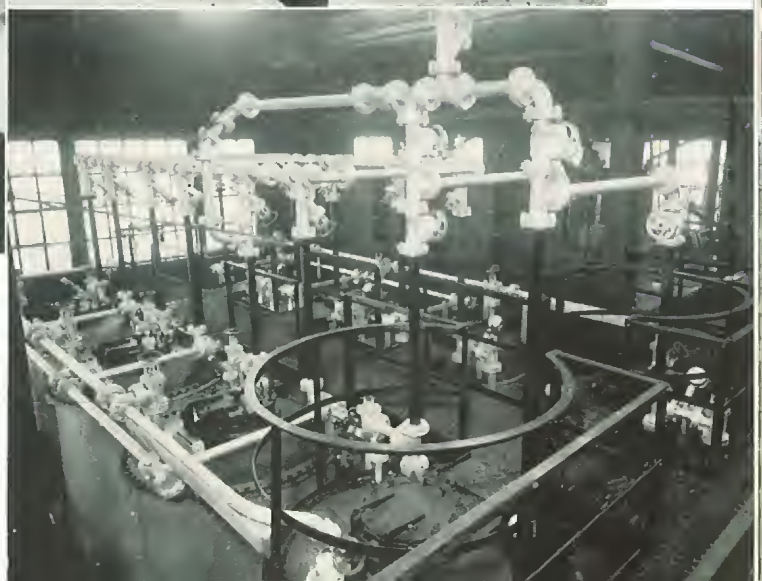
Antimonial or "hard" lead in sheet form is made from chemical lead, alloyed according to specification, with various percentages of antimony in order to obtain greater mechanical strength. The antimony contents usually specified range from 4% to 10%, 6% being specified in most cases.

The tensile strength of 6% antimonial lead is approximately twice that of chemical lead. This fact, combined with its greater hardness and stiffness, makes it a suitable material for use in tanks where the mechanical strain is severe or where linings are supported by a skeleton framework. Also antimonial lead has better abrasion resistance than chemical lead and is therefore better suited to installations where erosion is a problem. Finally, antimonial lead is more resistant to cutting or mechanical injury when hit or struck by harder metals and tends to give better service as a lining in tanks where this condition exists.

Due to the fact that antimony lowers the melting point of lead from 620°F to 477°F, antimonial lead is more affected than is chemical lead by elevated temperatures. As the heat rises, it loses its mechanical strength more rapidly as well as its ability to resist acid attack. Antimonial lead is not recommended for use with temperatures above 220°F–240°F.

Antimonial lead sheet is furnished in any gauge from 1/64" up. The specific gravity of antimonial lead is lower than that of chemical lead; consequently sheets of the same size and thickness are lighter. Antimonial lead sheet, containing from 4% to 6% of antimony, weighs approximately 3.2% less than chemical lead sheet.





Above: *Partly assembled evaporator in a by-product coke plant. Interior of the evaporator is lined with sheet lead. The "cracker pipe" at center and the large diameter connecting pipes shown in photo at upper right, are formed from heavy gauge antimonial lead sheet.*

Right: *A battery of selenium precipitate tanks in a copper refining plant. The tanks are lined with 6 per cent antimonial lead sheet.*

CRAWLPROOF SHEET LEAD

In tanks, vats or agitators where linings are subjected to a relatively severe strain, crawlproof sheet lead provides a greater measure of freedom from buckling, crawling and similar movements than does chemical lead sheet.

Crawlproof lead is chemical sheet lead reinforced in the center with antimonial lead bars. The bars are placed exactly like steel rods in reinforced concrete and firmly embedded so that no separation can take place.

Crawlproof sheet lead is furnished in any gauge from 1/32" up and in any size not exceeding 7½' in width by 35' in length. Each sheet is marked showing the direction of the reinforcing bars.

BURNING BAR OR ROD LEAD

An important feature of lead construction in chemical equipment is the welding or "burning" operation. Lead sheets are joined together by fusing them at a well-cleaned joint by means of a torch and a strip of lead known as a "burning bar". The latter is almost always of the same composition as the sheets to be joined.

We manufacture burning bar in any desired composition and any desired shape. Usually burning bar is furnished in circular wire form, 3/8" in diameter, and is shipped on reels.

ANTIMONIAL LEAD ANODES

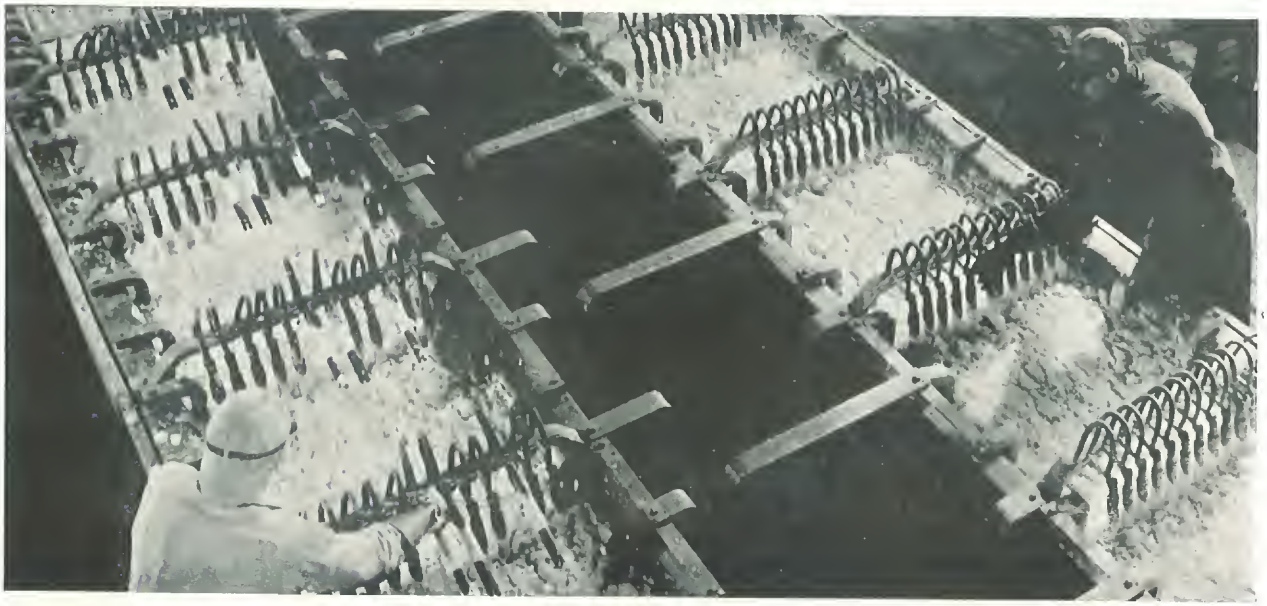
Lead anodes containing 6% antimony are used successfully in chromium-plating equipment. Experience has shown that they provide a uniform distribution of electrical current in the chromic acid bath and wear down evenly on both sides.

We manufacture antimonial lead anodes (or lead anodes of any other desired composition) in any size according to the customer's specification. The usual anode is in strip form, 1/8" to 1/4" thick, 4" to 8" wide and 20" to 36" long.

Our anodes are made only from pure metals, doubly refined. They are highly polished and free from all blemishes. They are packed flat, well protected for shipping.

In tanks where antimonial lead anodes are used, the tank lining should always be antimonial sheet lead, never chemical sheet lead.

Lead alloy anodes being used in a special process for zinc-coating steel wire. The coating is applied as the wire feeds through the lead-lined plating tanks.



NATIONAL LEAD COMPANY • *Atlantic Branch*
111 Broadway, New York 6, New York

LEAD-LINED EQUIPMENT

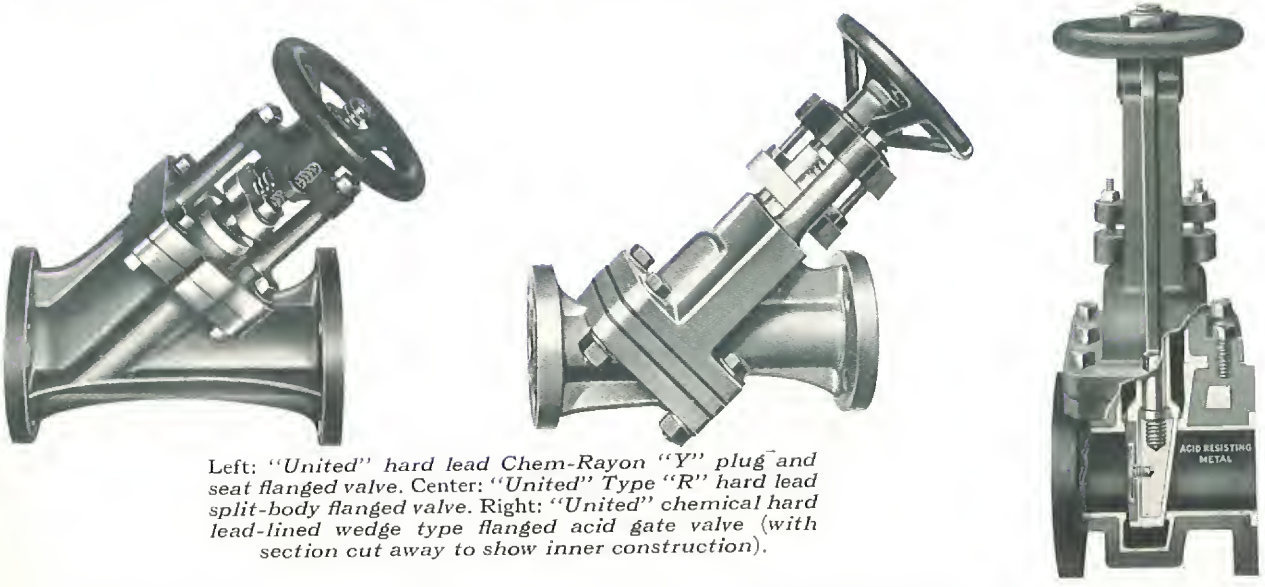
For some purposes in the chemical and acid industries, particularly where high pressures and temperatures, agitation or vacuum are involved, ordinary lead equipment lacks the mechanical strength necessary for long service. For use under severe operating conditions of this nature, we manufacture a complete line of lead-lined and hard (i.e. antimonial) lead equipment.

LEAD-LINED PIPE AND FITTINGS

"United Tubond" Lead-Lined Pipe is made by using steel pipe (or iron when specified) in accordance with the A.S.T.M. Standard Specifications. The lead lining is an extruded lead tube (chemical or antimonial) thoroughly bonded to the outer casing by the United Process. This method of manufacture insures a smooth interior in which friction is reduced to a minimum. Our standard lengths for this pipe are 20 feet. We are also equipped to furnish "United Tubond" Lead-Lined Pipe flanged and cut to your specifications. Expanded Lead-Lined Pipe can also be furnished.

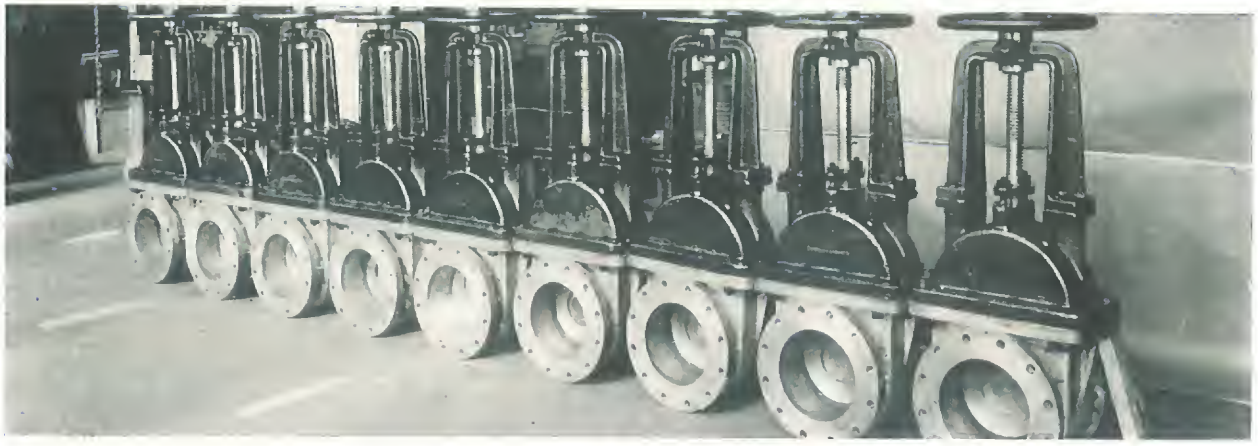
"United" Lead-Lined Fittings are made of cast iron or steel heavily lined with lead. They are cast oversize from our own patterns so that after they are lined they have a full flow area in their respective sizes. Flange diameters and templates for drilling conform to American Standards.

LEAD-LINED AND HARD LEAD VALVES



Left: *"United" hard lead Chem-Rayon "Y" plug and seat flanged valve.* Center: *"United" Type "R" hard lead split-body flanged valve.* Right: *"United" chemical hard lead-lined wedge type flanged acid gate valve (with section cut away to show inner construction).*

"United" Lead-Lined and Hard Lead Flanged Acid Valves are manufactured in all required sizes and patterns—"Y," angle, gate, check and diaphragm; also valves to meet special requirements. Our Lead-Lined Valves are furnished in the 125 lb. Standard Cast Iron and 150 lb. Standard Cast



A group of 10-inch hard lead wedge type gate valves for use in a rayon plant.

Carbon Steel. All interior parts coming in contact with the solution handled are substantially lined or covered with lead. Our Hard Lead Valves are well proportioned and sturdily constructed. Bodies are reinforced with fins cast integral, affording maximum strength while reducing weight to a minimum.

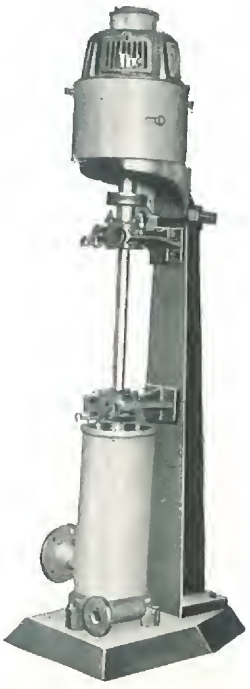
In addition to the foregoing mentioned valves in which the seats are cast integral with the body, we manufacture our "United" Type "R" Split-Body Flanged Valves made of Hard Lead or Lead-Lined Cast Iron or Steel. This type valve offers the following advantages:

(a) It can be installed as a "Y" or an angle pattern by simply reversing the position of the body sections. This eliminates the need for stocking both "Y" and angle pattern valves. (b) The seat and

plug disc are removable and can be replaced readily at a nominal cost, thus cutting valve maintenance costs. (c) The split-body design makes possible the use of any type of alloy plug disc and seat to meet requirements for handling various solutions.

HARD LEAD ACID RESISTANT PUMPS

Where gravity flow is not available to convey solutions to succeeding stages of operation, acid resisting pumps must be used. We manufacture hard lead centrifugal pumps of two types, the open or "horizontal" pattern and the vertical shaft pump. An unusual feature of the vertical pump is the elimination of the packing gland. The boot serves as both suction chamber and auxiliary supply tank. "United" horizontal pumps are self lubricating with large internal grease glands supplied by compression cups. The casing is of hard lead with the impeller of the same alloy cast around a reinforcing spider.



Left: "United" horizontal hard lead centrifugal acid pump. Right: "United" vertical hard lead centrifugal acid pump, packingless type.

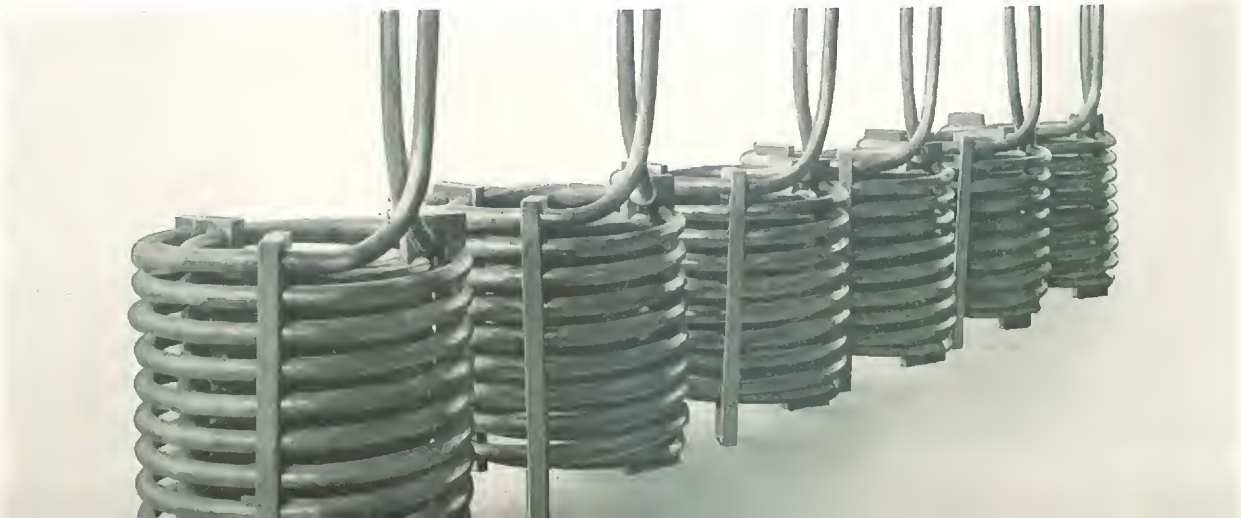
A battery of ten homogeneous lead-lined vertical steel blow cases ready for shipment to a chemical plant.

HOMOGENEOUS LEAD EQUIPMENT

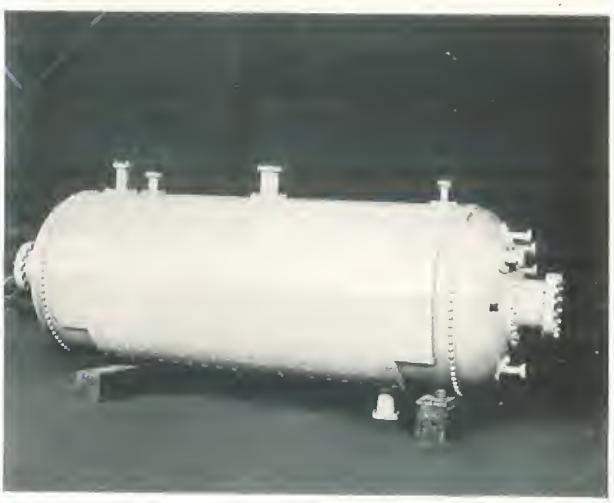
Homogeneous lead-lined or lead-covered apparatus, including such equipment as storage tanks, autoclaves, heating coils and jacketed pressure tanks of all descriptions, is designed for use under operating conditions where high steam pressure and vacuum are encountered, or where heat transfer is of importance. Equipment of this type manufactured by us is being successfully used by many industrial plants throughout the country and time and again has demonstrated its superiority over the older types of loose lined equipment.

The outstanding feature of homogeneous lined or covered equipment is the firm adherence of the lead. By our method of manufacture, the lead lining or covering is inseparably bonded to the steel, copper or brass of which a particular piece of

Six homogeneous lead-covered copper coils for use in a pigment manufacturing plant.



Above: *Three homogeneous lead-lined steam separators.* Below: *Lead-lined steam jacketed steel drum.*



apparatus is constructed. The bonding of the lead is accomplished by the application of the lead direct to the steel without the use of tin or tin-lead alloys. This method of bonding allows the equipment to operate at higher temperatures. The bond will not be broken unless heat is applied close to the melting point of lead (620°F.) and is capable of withstanding shock, vibration, vacuum and rapid changes in temperature.

Besides its application for the lining of tanks, kettles, stills, drums and the like, the homogeneous process is used successfully for the covering of agitators, propellers, and mixing devices of all descriptions.

SERVICE

Lined equipment for chemical and allied plants usually varies according to the type of operation for which it is intended. In the case of homogeneous equipment, for example, it is necessary to fabricate the apparatus to meet individual requirements. Our engineering department offers its service to anyone having acid contact problems to solve. If blue prints and sketches are submitted, we will be pleased to offer suggestions in detail as to the most economical and satisfactory use of our products. Address inquiries to National Lead Company, Lined Products Department, 111 Broadway, New York 6, N. Y.

TYPICAL INSTALLATIONS OF HOMOGENEOUS EQUIPMENT

EQUIPMENT	PRODUCT	CONTACT	TEMP.	STEAM PRESSURE	VACUUM
Tanks and Lead-Covered Coils	Alum	66° Be. to Dilute Sulphuric Acid	220° F.	—	—
Extractors, Scrubbers, Separators	Sulphur Dioxide	—	200° F.	60 lbs.	—
Autoclave	Chemicals	25% Sulphuric	300° F	—	—
Tank	Chemicals	14% Sulphuric	212° F.	110 lbs.	29½"
Tank Coils	Chemicals	Ferrous Sulphate, 25% Sulphuric	230° F.	40 lbs.	—
Tanks and Covers	Acid Recovery	Sulphuric Acid Mist	180° F.	—	29"
Tanks	Naphthalene	40% Sulphuric	200° F.	40 lbs.	—
Car Tanks	Battery Acid	66° Be. Sulphuric Acid	Atmosp.	—	—

LEAD PIPE

for water service and plumbing

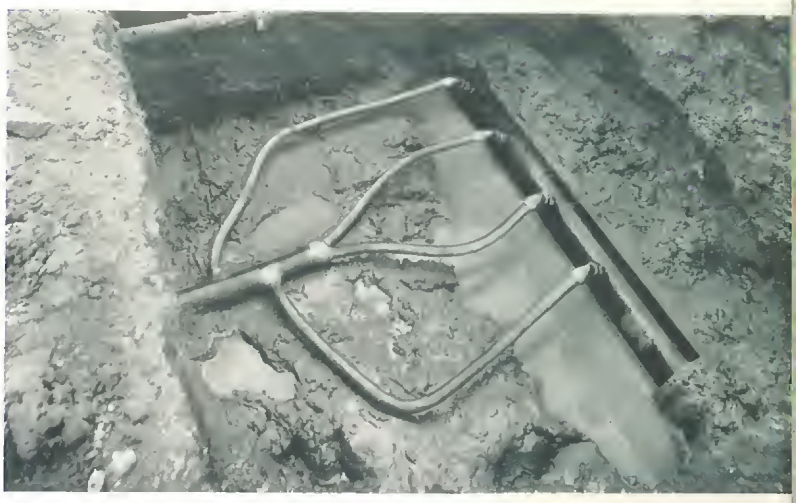
Lead pipe is widely used for water service and the waste and vent systems in plumbing. Among those responsible for the installation of such systems—water works engineers and the plumbing trade generally—lead pipe has long been recognized as ideal for the purpose.

For the underground piping which connects a residence or building with the water main, lead pipe has many advantages to recommend it. It resists soil corrosion and is less subject to perforation. Having smooth interior walls and a high hydraulic efficiency, it offers a minimum of resistance to water flow. Being pliant and flexible, it adjusts itself to ground settlement and, if the water freezes, is less likely to burst because it can expand slightly with the expanding water.

For the supply and waste systems inside a building, lead pipe is equally advantageous. Furnished in long continuous lengths, it is readily bent around corners and obstacles making fewer joints necessary. Frequent joints tend to impede water flow. Being flexible, lead pipe is less likely to be damaged by vibration or building settlement. Furthermore, lead pipe does not clog from rusting,

ADVANTAGES OF LEAD PIPE

1. **Durable**
   Lead pipe lasts indefinitely.
2. **Flexible**
   Lead pipe is flexible . . . adjusts itself to building or ground settlement.
3. **Fewer Joints Needed**
   Lead pipe comes in long, continuous lengths . . . is readily bent around corners and obstacles. There are thus fewer joints to impede water flow.
4. **Less Trouble From Freeze-Ups**
   Freeze-ups are less likely to burst lead pipe. It expands with the expanding water.
5. **Hydraulic Efficiency**
   Lead pipe offers less resistance to water flow than other types of metal pipe.
6. **Non-Rusting**
   Lead does not rust. Therefore lead pipe never clogs from this cause.
7. **Non-Staining**
   Water flowing through lead pipe does not discolor . . . will not stain expensive bath or kitchen fixtures.
8. **Corrosion-Resistant**
   Lead pipe resists soil corrosion as well as the action of many acids and chemicals.
9. **High Salvage Value**
   Discarded lead installations have a high scrap value.
10. **Low Cost Per Year**
    The exceptional durability of lead pipe makes its cost per year of service lower than that of pipe made from any other material.



Above: *Typical lead water service showing the multiple tapping method employed when a large service is connected to a small main.* Below: *Lead roughing-in for a battery of four lavatories.*

nor does it discolor water leading to the staining of expensive fixtures.

Many building codes require the use of lead pipe for the waste and vent systems. This is a sanitary precaution based on the proven dependability of lead pipe—its record in countless installations of trouble-free service year in and year out.

Above: *Uncoiling lead pipe in a trench before attaching to water main.* Below: *Bending lead pipe. Note the bending spring inserted in the pipe.* Right: *A graphic illustration of lead's flexibility and the advantage taken of it by a skilled plumber.*

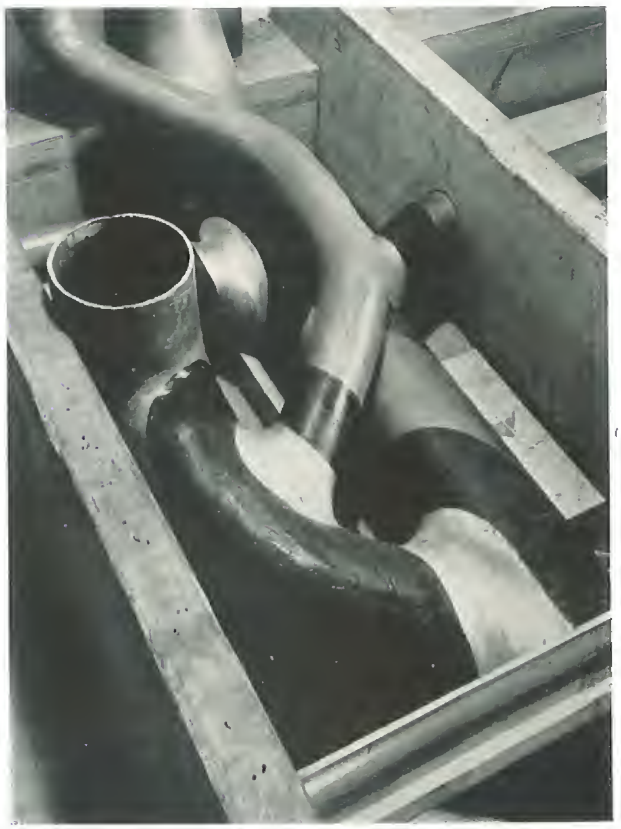
MANUFACTURE OF LEAD PIPE

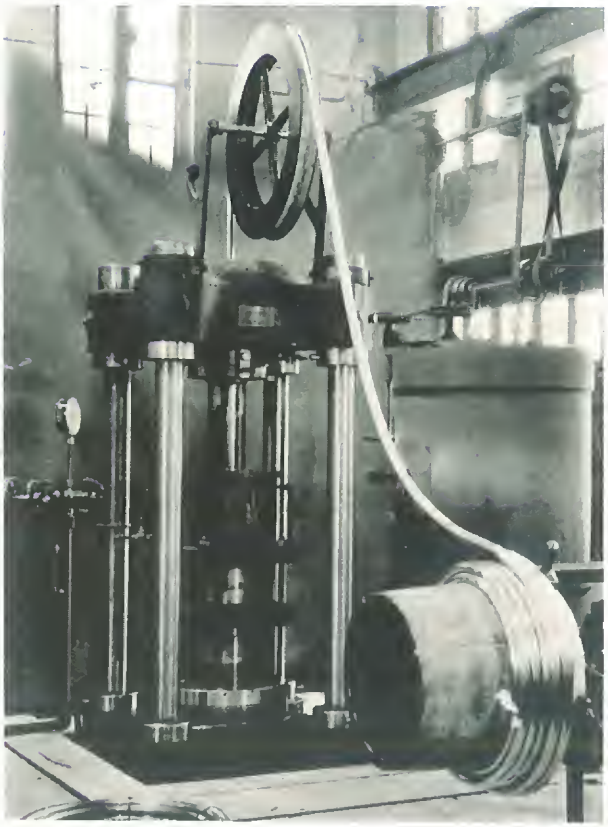
Our lead pipe—sold under the Dutch Boy trademark—is manufactured by the extrusion process in modern hydraulic presses. In this process, the lead, at a carefully regulated temperature, is forced under heavy pressure through a die and around a core to form continuous lengths of seamless, smooth-bore pipe.

Only standard accepted brands of refined lead are used. Only skilled operators handle the presses. Every care is taken to obtain uniform wall thickness, correct weight per foot and freedom from defects that might cause weakness. The result is lead pipe of the highest possible quality, designed to render long, honest service.

SIZES AND WEIGHTS

Due to the nature of the extrusion process, lead pipe can be produced in a wide range of diameters and weights. A selected list of sizes is given on the second page following. This list conforms to the national standard of lead pipe sizes and weights





approved by the Lead Industries Association and adopted by most lead pipe manufacturers.

Our lead pipe, bends and traps for plumbing and water distribution conform to FEDERAL SPECIFICATION WW-P-325

An outstanding feature of the approved list is that all sizes of pipe in the A, AA, and AAA classifications (Federal designations Class 50, Class 75 and Class 100, respectively) will safely withstand constant cold water pressures as follows:

A (or "Strong") ..... 50 lbs.
AA (or "Extra Strong") ..... 75 lbs.
AAA (or "Double Extra Strong") .....100 lbs.

Heretofore, the safe working pressures of these classes of pipe often decreased as the diameter increased.

MARKING

All lead pipe shown on the accompanying list in sizes from ½" I.D. to 2" I.D., whether coiled or

Left: *Modern hydraulic press extruding seamless, smooth-bore lead pipe.* Above: *This photo shows the marking which appears on lead pipe sold under the Dutch Boy trademark.* Below: *Coils of lead pipe before and after packing for shipment.*

in lengths, is stamped as shown in the photograph above. This stamping, which includes the Lead Industries Association "Seal of Approval" and the National Lead Company name and trademark, appears approximately every thirteen inches. The I.D. and weight per foot are stamped on one end.

PACKING

Every precaution is taken to wrap and pack our lead pipe properly to protect it for handling and shipment to the consumer. The method and manner of packing and the protective coverings used depend, of course, upon the materials available at time and place of shipment. Certain types and sizes of pipe are shipped in coils or on reels, others in standard lengths, unless otherwise specified.

LEAD PIPE SIZES AND WEIGHTS

The sizes and weights given in this table are those approved by the Lead Industries Association as standard for plumbing purposes. Lead pipe in other weights and in sizes up to and including 12" I.D. can be furnished on short notice.

NOMINAL SIZE INSIDE DIAMETER	CLASSIFICATION EAST	CLASSIFICATION WEST	NOMINAL SIZE OUTSIDE DIAMETER	NOMINAL WALL THICKNESS	NOMINAL WEIGHT PER FOOT
Inches			Inches	Inch	Pounds
3/8"	E	AQ	.520	.072	.50
	D	XL	.549	.087	.62
	C	L	.577	.101	.74
	B	M	.631	.128	.99
	A	S	.725	.175	1.49
	AA	XS	.811	.218	2.00
	AAA	XXS	.888	.256	2.50
1/2"	E	AQ	.628	.064	.56
	D	XL	.666	.083	.75
	C	L	.712	.106	.99
	B	M	.756	.128	1.24
	A	S	.798	.149	1.49
	AA	XS	.876	.188	1.99
	AAA	XXS	1.012	.256	2.99
5/8"	E	AQ	.765	.070	.75
	D	XL	.803	.089	.98
	C	L	.881	.128	1.51
	B	M	.953	.164	2.00
	A	S	1.019	.197	2.55
	AA	XS	1.082	.228	3.01
	AAA	XXS	1.137	.256	3.48
3/4"	E	AQ	.906	.078	1.00
	D	XL	.940	.095	1.24
	C	L	1.006	.128	1.73
	B	M	1.068	.159	2.23
	A	S	1.156	.203	2.99
	AA	XS	1.212	.231	3.50
	AAA	XXS	1.336	.293	4.72
1"	E	AQ	1.19	.096	1.62
	D	XL	1.23	.116	2.00*
	C	L	1.285	.142	2.50
	B	M	1.355	.178	3.23
	A	S	1.43	.214	4.01
	AA	XS	1.49	.246	4.73
	AAA	XXS	1.596	.298	5.97
1 1/4"	E	AQ	1.44	.096	1.99
	D	XL	1.485	.118	2.49*
	C	L	1.53	.139	2.98
	B	M	1.59	.171	3.75
	A	S	1.67	.210	4.73
	AA	XS	1.765	.257	5.99
	AAA	XXS	1.89	.319	7.74
1 1/2"	E	AQ	1.740	.120	3.00
	D	XL	1.775	.138	3.49*
	C	L	1.83	.165	4.24
	B	M	1.88	.191	4.98
	A	S	1.985	.242	6.51
	AA	XS	2.075	.288	7.95
	AAA	XXS	2.27	.386	11.24
1 3/4"	D	XL	2.025	.137	3.99
	C	L	2.085	.168	4.97
	B	M	2.145	.198	5.95
	A	S	2.195	.221	6.74
	AA	XS	2.405	.327	10.5
	AAA	XXS	2.625	.437	14.8
2"	E	AQ	2.185	.092	2.98
	D	XL	2.285	.142	4.69*
	C	L	2.355	.177	5.94
	B	M	2.41	.205	6.97
	A	S	2.505	.251	8.74
	AA	XS	2.75	.375	13.8
	AAA	XXS	3.01	.504	19.4
2 1/2"			2.75	.125	5.07
			3.00	.250	10.63
3"			3.25	.125	6.04*
			3.50	.250	12.56
4"			4.25	.125	7.99*
			4.50	.250	16.42
5"			5.25	.125	9.90
			5.50	.250	20.29
6"			6.25	.125	11.84
			6.50	.250	24.15

*This is the minimum recommended weight for pipe of this size to be used for soil, waste, vent or flush pipes and for bends and traps.

LEAD FITTINGS

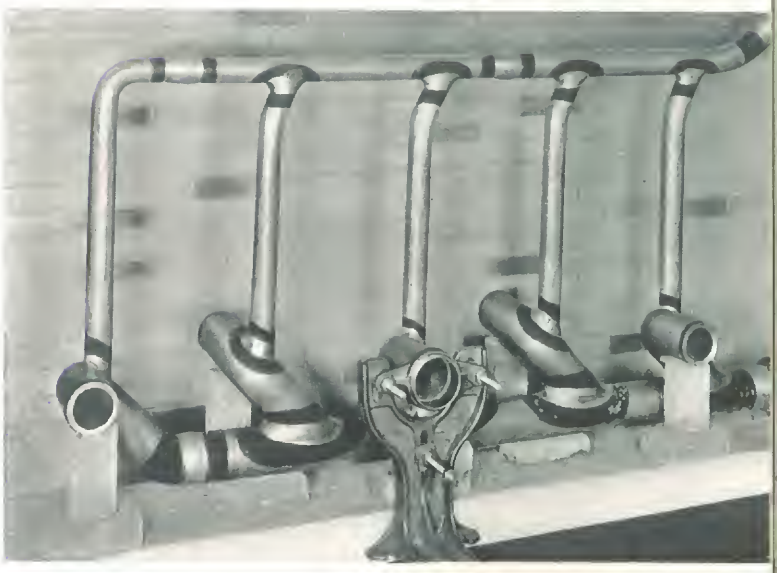
As shown on the following pages, we manufacture a full line of lead fittings and accessories for use in plumbing systems. The line includes traps of various designs in all standard patterns, short, long, and extension bends, combination ferrules, combination bends and ferrules and soldering nipples of various types.

In addition to these products which are stock items and can be supplied on short notice, we also manufacture closed-end bends and ferrules used by plumbers to test their roughing-in work, deep seal traps and ground joint vented traps, the special traps used in the Southern and New England districts, and lead or lead alloy fittings in special sizes, shapes and weights.

Our plumbing accessories can be depended upon to be of the highest quality in every respect. They are made from pure, refined lead only. The accuracy of our dies and the care and skill of our workmen insure correct shape and a uniform wall thickness throughout. Where a national weight standardization exists, such as in traps and bends, each product is stamped individually with the Lead Industries' "Seal of Approval," as well as with our name and trademark, and the size and weight.

Our fittings conform to Federal Specification WW-P-325.

To facilitate ordering, we have given as complete data as possible on the following pages. These include prices, details of construction, suggestions for ordering, methods of packing and price list for extras when differing from regular specifications.



Top: *Lead drum trap with inlet and outlet connections wiped on. Note that both connections are made near the base of the trap at right angles, giving water in the trap a swirling, and thus a cleaning motion.* Center: *Lead bends and piping for a battery of five wall-hung closets. "Chairs," similar to the one under the center bend, will be installed under the others for the permanent support of the closets.* Bottom: *Extruding lead trap on hydraulic press. The lead is forced under pressure through the die. Manipulation of valves produces bends.*

LEAD TRAPS

Our lead traps are carefully made from the best grade of pure refined lead. They are extruded under high pressure, insuring a smooth interior and uniformity in wall thickness throughout the entire length. They conform to Federal Specification WW-P-325.

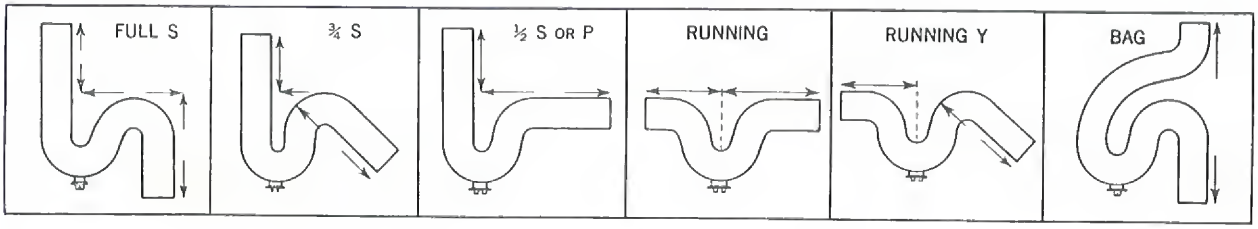
Lead traps in all the standard styles and sizes come either vented or unvented. Extra long designs in all sizes are furnished with either long inlet or long outlet.

In ordering drain traps, specify style, inside diameter and weight division. State whether vented or unvented is desired. Unless otherwise specified "standard weight" unvented will be furnished.

In ordering extra long traps, specify whether long inlet or long outlet is desired.

DIMENSION SCALE FOR REGULAR TRAPS

Note: *Dimensions are taken on inlet, outlet, length over all and from center to ends.*



Size	Full S		¾ S		½ S or P		Running		Running Y		Bag
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Length Over All
1¼"	4¼"	6¼"	4¼"	5¼"	4½"	6"	4½"	5½"	4½"	5¼"	11½"
1½"	4½"	7"	4½"	6"	4½"	7"	5¼"	6¼"	5¼"	6"	13"
2"	4½"	8"	4½"	7½"	4½"	8"	5¼"	7½"	5¼"	7½"	15"
3"	4"	10½"	4"	10"	4"	9½"	7½"	7½"	7½"	10"	18½"
4"	3¼"	11½"	3¼"	11"	3¼"	10"	8"	8"	8"	11"	22½"

DIMENSION SCALE FOR EXTRA LONG TRAPS

Note: *Dimensions are taken as shown by arrows on illustrations of regular traps above.*

Size	Full S	¾ S		½ S or P		Running		Running Y		Bag
	Length Over All	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Length Over All
1¼"	24"	4¼"	16¼"	4¼"	14¼"	4½"	17½"	4½"	16¼"	24"
1½"	24"	4½"	15¾"	4½"	14"	5¼"	16¾"	5¼"	15¾"	24"
2"	24"	4¼"	15½"	4½"	14"	5¼"	16¾"	5¼"	15½"	24"

REGULAR AND EXTRA LONG TRAPS

U. S. STANDARD PRICE LIST

		Standard (Lightest) Weight				Special (Medium) Weight		Extra Heavy Weight				
Weight in Lbs. Per Running Foot		2¼	3¼	5	6	3	4	2½	3½	4½	6	8
Diameter—Inches		1½	2	3	4	1½	2	1¼	1½	2	3	4
Full S	—Regular	$0.90	$1.38	$2.69	$3.25	$1.03	$1.65	$0.87	$1.25	$1.85	$3.09	$4.30
	—Extra Long	1.36	2.00			1.64	2.40	1.44	1.95	2.69		
¾ S	—Regular	.81	1.30	2.62	3.07	.94	1.53	.81	1.15	1.73	2.97	3.95
	—Extra Long	1.19	1.76			1.43	2.08	1.28	1.72	2.33		
½ S or P	—Regular	.75	1.20	2.24	2.49	.87	1.42	.77	1.09	1.57	2.58	3.25
	—Extra Long	1.02	1.55			1.22	1.83	1.14	1.50	2.02	3.25	
Running	—Regular	.72	1.13	2.09	2.53	.87	1.32	.70	1.03	1.46	2.35	3.28
	—Extra Long	1.15	1.67			1.41	1.98	1.23	1.65	2.18		
Running Y	—Regular	.76	1.34	2.46	3.15	.94	1.45	.74	1.09	1.61	2.88	4.05
	—Extra Long	1.15	1.82			1.45	2.01	1.23	1.52	2.23		
Bag	—Regular	1.08	1.73	3.35	4.77	1.28	2.08	1.06	1.54	2.33	3.96	6.30
	—Extra Long	1.58	2.34			1.91	2.80	1.67	2.24	3.11		

REGULAR AND EXTRA LONG VENTED TRAPS

U. S. STANDARD PRICE LIST

		Standard (Lightest) Weight					Special (Medium) Weight			Extra Heavy Weight					
Weight In Lbs. Per Running Ft.		2¼	3¼		5	6	3	4		2½	3½	4½		6	8
Diameter—Inches		1½	2*		3	4	1½	2*		1¼	1½	2*		3	4
Vent Size—Inches		1½	1½	2	2	2	1½	1½	2	1¼	1½	1½	2	2	2
Full S	—Regular	$1.85	$2.33	$2.63	$3.94	$4.50	$1.98	$2.60	$2.90	$1.67	$2.20	$2.80	$3.10	$4.34	$5.55
	—Extra Long	2.31	2.95	3.25			2.59	3.35	3.65	2.24	2.90	3.64	3.94		
¾ S	—Regular	1.76	2.25	2.55	3.87	4.32	1.89	2.48	2.78	1.61	2.10	2.68	2.98	4.22	5.20
	—Extra Long	2.14	2.71	3.01			2.38	3.03	3.33	2.08	2.67	3.28	3.58		
½ S or P	—Regular	1.70	2.15	2.45	3.49	3.74	1.82	2.37	2.67	1.57	2.04	2.52	2.82	3.83	4.50
	—Extra Long	1.97	2.50	2.80			2.17	2.78	3.08	1.94	2.45	2.97	3.27		
Running	—Regular	1.67	2.08	2.38	3.34	3.78	1.82	2.27	2.57	1.50	1.98	2.41	2.71	3.60	4.53
	—Extra Long	2.10	2.62	2.92			2.36	2.93	3.23	2.03	2.60	3.13	3.43		
Running Y	—Regular	1.71	2.29	2.59	3.71	4.40	1.89	2.40	2.70	1.54	2.04	2.56	2.86	4.13	5.30
	—Extra Long	2.10	2.77	3.07			2.40	2.96	3.26	2.03	2.47	3.18	3.48		
Bag	—Regular	2.03	2.68	2.98	4.60	6.02	2.23	3.03	3.33	1.86	2.49	3.28	3.58	5.21	7.55
	—Extra Long	2.53	3.29	3.59			2.86	3.75	4.05	2.47	3.19	4.06	4.36		

*2″ traps have 1½″ vent connections unless otherwise specified.
For nickel plating on 1¼″ and 1½″ vents, add 75 cents to list price; on 2″ vents, add $1.00.

STOCK PACKAGES OF LEAD TRAPS

	1¼″		1½″		2″		3″		4″
	Plain	Vented	Plain	Vented	Plain	Vented	Plain	Vented	Plain
A Barrel of Full S Contains	75	50	50	36	24	20	10	8	6
A Barrel of ¾ S Contains	75	50	50	36	24	20	10	8	6
A Barrel of ½ S or P Contains	75	50	50	36	24	20	12	12	8
A Barrel of Running Contains	100	60	72	50	36	24	12	12	8
A Barrel of Running Y Contains	75	30	50	24	24				
A Barrel of Bag Contains	50	30	36	24	18				

Stock packages of extra long traps contain approximately 30 1¼″, 25 1½″ and 20 2″.

CHEMICAL LABORATORY TRAPS

Made of Chemical Lead with cleanout and ring of hard lead for protection against acid waste of laboratory sinks. Body is 3″ inside diameter, 1/8″ thick and 8″ long with a 2 1/2″ cleanout, the ring of which is lead burned to the body. Inlet and outlet are 1 1/2″ XH Lead and are lead burned to the body.

Special sizes made on special order. Write for prices.

ULCO NON-SIPHON LEAD TRAPS

Ulco Non-Siphon traps are made of drawn lead. Both the inlet and outlet are extruded as is the ball or anti-siphoning feature which is then spun to size and lead-burned in place. These traps are ruggedly constructed and highly efficient.

In ordering, specify size, style and weight division. The dimension scale for these traps is the same as for regular traps.

PRICE LIST ULCO NON-SIPHON LEAD TRAPS

	Standard Weight		Medium Weight			Extra Heavy Weight		
Weight In Lbs. Per Running Foot	2¼	3¼	2	3	4	2½	3½	4½
Size	1½″	2″	1¼″	1½″	2″	1¼″	1½″	2″
Full S	$2.25	$3.10	$2.10	$2.40	$3.35	$2.25	$2.60	$3.55
¾ S	2.20	3.00	2.10	2.30	3.25	2.20	2.50	3.45
½ S or P	2.10	2.90	2.00	2.20	3.15	2.15	2.45	3.30
Running	2.10	2.90	2.00	2.20	3.15	2.15	2.45	3.30
Full S—Long Inlet No. 1	2.70	3.70	2.55	3.00	4.10	2.80	3.30	4.40
Full S—Long Outlet No. 2	2.70	3.70	2.55	3.00	4.10	2.80	3.30	4.40
¾ S—Long Inlet No. 11	2.55	3.50	2.40	2.80	3.80	2.65	3.10	4.05
¾ S—Long Outlet No. 12	2.55	3.50	2.40	2.80	3.80	2.65	3.10	4.05
½ S or P—Long Inlet No. 3	2.40	3.25	2.30	2.60	3.55	2.50	2.90	3.75
½ S or P—Long Outlet No. 4	2.40	3.25	2.30	2.60	3.55	2.50	2.90	3.75

DRUM TRAPS

Our drum traps are made from pure, refined lead, drawn and then spun to insure a smooth, seamless wall of uniform thickness. They are furnished in a variety of patterns with screws of either plain brass, polished brass, nickel-plated or chromium-plated finishes.

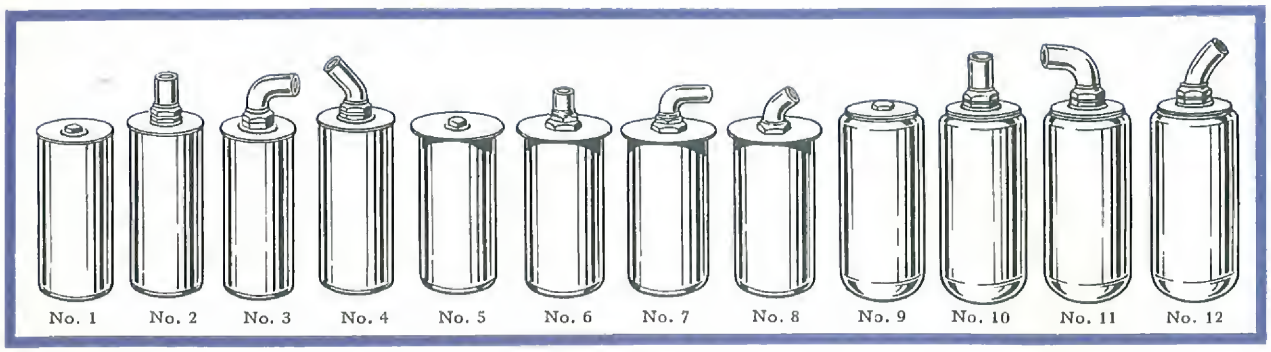
In ordering drum traps, state the style by number, the weight division, diameter and length of body and the screw finish.

4″ HARD LEAD DRUM CAP SCREW

A uniform, high-pressure die casting of dense grain which will be serviceable for many years. It is especially intended for concealed installations where costlier fittings are not required.

Though economically priced, this screw is a quality product of generous weight and proportion, sharp threads and fine finish.

The cover measures 4 1/8″ outside diameter, is 1/8″ thick with 3″ I.P.T.



DRUM TRAPS

U. S. STANDARD PRICE LIST

Drum Traps Complete (Screws Ordinary Finish)*	Regular Pattern							New England Pattern			Drum Traps Without Screws
	No. 1	No. 2	Nos. 3 & 4	No. 5	No. 5½	No. 6	Nos. 7 & 8	No. 9	No. 10	Nos. 11 & 12	
4 x 8 Standard Weight	$1.90	$2.60	$3.00	$2.00	$2.10	$2.80	$3.20	$1.90	$2.60	$3.00	$0.90
4 x 9 Standard Weight	2.02	2.72	3.12	2.12	2.22	2.92	3.32	2.02	2.72	3.12	1.02
4 x 10 Standard Weight	2.10	2.80	3.20	2.20	2.30	3.00	3.40	2.10	2.80	3.20	1.10
4 x 11 Standard Weight	2.18	2.88	3.28	2.28	2.38	3.08	3.48	2.18	2.88	3.28	1.18
4 x 12 Standard Weight	2.25	2.95	3.35	2.35	2.45	3.15	3.55	2.25	2.95	3.35	1.25
4 x 14 Standard Weight	2.55	3.25	3.65	2.65	2.75	3.45	3.85	2.55	3.25	3.65	1.55
5 x 10 Standard Weight	3.00	3.70	4.10	3.10	3.20	3.90	4.30	3.00	3.70	4.10	2.00
5 x 11 Standard Weight	3.15	3.85	4.25	3.25	3.35	4.05	4.45	3.15	3.85	4.25	2.15
5 x 12 Standard Weight	3.30	4.00	4.40	3.40	3.50	4.20	4.60	3.30	4.00	4.40	2.30
6 x 10 Standard Weight	3.55	4.25	4.65	3.65	3.75	4.45	4.85	3.55	4.25	4.65	2.55
6 x 11 Standard Weight	3.75	4.45	4.85	3.85	3.95	4.65	5.05	3.75	4.45	4.85	2.75
6 x 12 Standard Weight	3.90	4.60	5.00	4.00	4.10	4.80	5.20	3.90	4.60	5.00	2.90
4 x 8 Special Weight	2.05	2.75	3.15	2.15	2.25	2.95	3.35	2.05	2.75	3.15	1.05
4 x 9 Special Weight	2.18	2.88	3.28	2.28	2.38	3.08	3.48	2.18	2.88	3.28	1.18
4 x 10 Special Weight	2.27	2.97	3.37	2.37	2.47	3.17	3.57	2.27	2.97	3.37	1.27
4 x 11 Special Weight	2.37	3.07	3.47	2.47	2.57	3.27	3.67	2.37	3.07	3.47	1.37
4 x 12 Special Weight	2.45	3.15	3.55	2.55	2.65	3.35	3.75	2.45	3.15	3.55	1.45
4 x 14 Special Weight	2.75	3.45	3.85	2.85	2.95	3.65	4.05	2.75	3.45	3.85	1.75
4 x 8 Extra Heavy Weight	2.40	3.10	3.50	2.50	2.60	3.30	3.70	2.40	3.10	3.50	1.40
4 x 9 Extra Heavy Weight	2.50	3.20	3.60	2.60	2.70	3.40	3.80	2.50	3.20	3.60	1.50
4 x 10 Extra Heavy Weight	2.63	3.33	3.73	2.73	2.83	3.53	3.93	2.63	3.33	3.73	1.63
4 x 11 Extra Heavy Weight	2.75	3.45	3.85	2.85	2.95	3.65	4.05	2.75	3.45	3.85	1.75
4 x 12 Extra Heavy Weight	2.90	3.60	4.00	3.00	3.10	3.80	4.20	2.90	3.60	4.00	1.90
4 x 14 Extra Heavy Weight	3.30	4.00	4.40	3.40	3.50	4.20	4.60	3.30	4.00	4.40	2.30
5 x 10 Extra Heavy Weight	3.40	4.10	4.50	3.50	3.60	4.30	4.70	3.40	4.10	4.50	2.40
5 x 11 Extra Heavy Weight	3.55	4.25	4.65	3.65	3.75	4.45	4.85	3.55	4.25	4.65	2.55
5 x 12 Extra Heavy Weight	3.70	4.40	4.80	3.80	3.90	4.60	5.00	3.70	4.40	4.80	2.70
6 x 10 Extra Heavy Weight	4.15	4.85	5.25	4.25	4.35	5.05	5.45	4.15	4.85	5.25	3.15
6 x 11 Extra Heavy Weight	4.35	5.05	5.45	4.45	4.55	5.25	5.65	4.35	5.05	5.45	3.35
6 x 12 Extra Heavy Weight	4.60	5.30	5.70	4.70	4.80	5.50	5.90	4.60	5.30	5.70	3.60
*For polished brass, nickel plated or chromium plated screw finishes, add	.20	.30	.30	.20	.25	.30	.30				

(Drum Traps with iron pipe threads also available.)

DRUM TRAP ACCESSORIES

Price of Screws	No. 1	No. 2	Nos. 3 & 4	No. 5	No. 5½	No. 6	Nos. 7 & 8
Drum Trap Screws—Ordinary Finish	$1.00	$1.70	$2.10	$1.10	$1.20	$1.90	$2.30
Drum Trap Screws—Nickel or Chromium Plated	1.20	2.00	2.40	1.30	1.45	2.20	2.60
Details of Screws							
Outside Diameter of Cap—Face	4⅛"	4⅛"	4⅛"	4½"	5"	4½"	4½"
Outside Diameter of Cap—Threads	3¾"	3¾"	3¾"	3¾"	3¾"	3¾"	3¾"
Inside Diameter of Ring	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"
Number of Threads to Inch	16	16	16	16	16	16	16
Flange Extends Beyond Body				3/16"	3/16"	5/16"	5/16"

WEIGHT OF LEAD USED FOR DRUM TRAPS

4-inch Standard equals Lead Pipe weighing 5 lbs. per ft.
4-inch Special equals Lead Pipe weighing 6 lbs. per ft.
4-inch Extra Heavy equals Lead Pipe weighing 8 lbs. per ft.
5-inch Standard equals Lead Pipe weighing 8¼ lbs. per ft.
5-inch Extra Heavy equals Lead Pipe weighing 10 lbs. per ft.
6-inch Standard equals Lead Pipe weighing 10 lbs. per ft.
6-inch Extra Heavy equals Lead Pipe weighing 13 lbs. per ft.

LEAD BENDS

We manufacture a complete assortment of lead bends to meet every modern building requirement. All bends are extruded under high pressure from refined lead only. They are uniform in wall thickness and true to size.

In ordering, specify weight division, inside diameter, type of inlet and length of outlet.

DIMENSION SCALE FOR LEAD BENDS

Dimensions are taken as shown by arrows	SHORT BEND	LONG BEND
SIZE	CENTER TO ENDS	CENTER TO ENDS
1¼-inch	6 inches 3½	6 inches
1½ "	7 " 4	7 "
2 "	7¾ " 3¾	7¾ "
3 "	8¾ " 4¼	8¼ "
4 "	10 " 5½	10 "

COMBINATION (Lead and Iron) BENDS and FERRULES

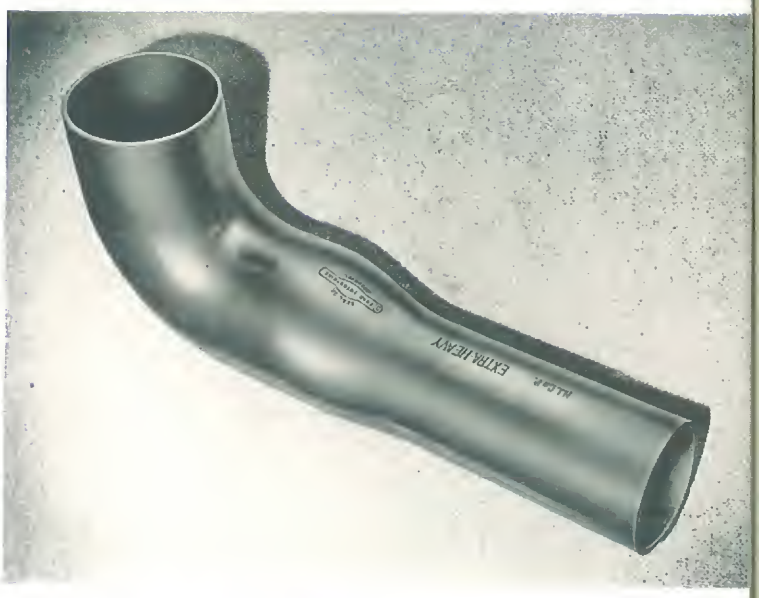
Our combination bends and ferrules are carefully manufactured to insure ease of installation and a tight connection. They are fitted with a cast iron drive ferrule of the highest quality.

COMBINATION (Lead and Iron) FERRULES

Our combination ferrules come up to the same high standard as our bends and ferrules. Made only from first-grade metals, they can be depended upon to give long satisfactory service.

LEAD REDUCING BENDS

Increased use of three-inch stacks on Defense Housing projects during the war called for lead reducing bends with a four-inch inlet and a three-inch outlet. Lead reducing bends of our manufacture meet the rigid standards set up by Lead Industries Association. One of the principal provisions of this standard provides that the bottom of the bend, when installed, shall be smooth and straight so that it cannot form a trap for substances passing through the bend. In the approved reducing bend the reduction in diameter occurs exclusively on the top and sides, leaving the bottom of the bend smooth, straight and without obstruction.



IMPROVED (Lead and Iron) FERRULE COMBINATION

Lead and Iron Ferrules and Bends and Ferrules are now available in improved pattern.

The Improved Lead and Iron Ferrule is spun with an extra long ferrule on the outside, eliminating any possibility of melting or puncturing lead stub or bend when pouring and calking lead in hub.

Smooth all lead interior provides for free, unrestricted flow of waste.

The iron ferrule is completely insulated from moisture, thereby safeguarding against rust or corrosion.

Lead is spun back tightly over the bead of the ferrule to prevent rupture of joint resulting from unusual settlement of fixture or stack.

A non-hardening rubber base cement is applied at this junction to provide a plastic seal against gas leakage.

Available in all customary sizes. 4″ diameter, in lengths not exceeding 14″, packed in individual cartons of 6 to a standard container.

HARD LEAD CLOSET FLOOR FLANGES

A high-pressure, injection molded die casting with maximum tensile strength, hardness and dense grain, thus offering higher resistance to bending or fracturing than hand or gravity cast lead flanges and light weight brass sand castings.

An enduring lead alloy which only requires candling to permit quick soldering to bend or stub.

Cut below shows flange attached to inlet end of bend. Flange may be joined to bend or stub by a wiped or soldered joint, or by lead welding.

Dimensions conform with Lead Industries Association's requirements; 3/8" thick rim, 4 slots for bowl connection, and weighing not less than 25 oz. Packed in Cartons of 25 each.

HARD LEAD FERRULES

These antimonial lead fittings are as highly resistant to corrosion as is the common lead forming the main soil and waste drainage system. The wall is of uniform thickness, the interior surface is mirror-smooth. Installation may be made in the regular manner or the ferrules may be joined by welding or lead burning. Complete instructions are printed on label attached to each ferrule.

SHORT AND LONG BENDS • EXTENSION BENDS

U. S. STANDARD PRICE LIST

	Standard (Lightest) Weight					Special (Medium) Weight			Extra Heavy Weight				
Weight Per Running Foot In Pounds..	1½	2¼	3¼	5	6	2	3	4	2½	3½	4½	6	8
Diameter In Inches	1¼	1½	2	3	4	1¼	1½	2	1¼	1½	2	3	4
Short Bend	$0.25	$0.38	$0.57	$1.09	$1.50	$0.31	$0.51	$0.69	$0.34	$0.62	$0.80	$1.21	$1.84
Long Bend	.30	.50	.78	1.39	1.95	.41	.66	1.00	.50	.79	1.05	1.60	2.40
*Short Inlet—12″ Outlet	.40	.56	.79	1.39	1.70	.52	.75	.99	.60	.90	1.08	1.57	2.09
*Short Inlet—15″ Outlet	.47	.67	.94	1.65	2.00	.62	.89	1.17	.72	1.07	1.28	1.87	2.45
*Short Inlet—18″ Outlet	.55	.77	1.09	1.90	2.30	.72	1.03	1.36	.84	1.24	1.49	2.16	2.81
*Short Inlet—20″ Outlet	.60	.84	1.19	2.07	2.48	.79	1.12	1.49	.92	1.35	1.63	2.35	3.04
*Long Inlet—12″ Outlet	.46	.67	.99	1.73	2.15	.60	.89	1.24	.70	1.07	1.35	1.96	2.62
*Long Inlet—15″ Outlet	.54	.77	1.14	1.99	2.44	.70	1.03	1.42	.82	1.24	1.56	2.25	2.98
*Long Inlet—18″ Outlet	.62	.88	1.29	2.24	2.73	.80	1.17	1.61	.94	1.41	1.76	2.54	3.34
*Long Inlet—20″ Outlet	.67	.95	1.39	2.42	2.92	.87	1.26	1.74	1.02	1.52	1.90	2.74	3.58
For each inch of length over listed size, add	.03¼	.04½	.06¼	.10¾	.12	.04¼	.06	.07¾	.05	.07	.08½	.12	.15

*Short inlets are same dimensions as inlets on short bends of corresponding size; long inlets are same as on long bends.

STOCK PACKAGES

A Barrel of Short Bends Contains	150	75	60	30	15	150	75	60	150	75	60	30	15
A Barrel of Long Bends Contains	100	50	36	24	12	100	50	36	100	50	36	24	12

COMBINATION (LEAD AND IRON) BENDS AND FERRULES

U. S. STANDARD PRICE LIST

Length of Outlet	12″	13″	14″	15″	16″	17″	18″	19″	20″
Standard Weight									
4″ Short Inlet*	$2.20	$2.30	$2.40	$2.50	$2.60	$2.70	$2.80	$2.90	$3.00
4″ Long Inlet**	2.65	2.75	2.85	2.94	3.04	3.14	3.23	3.33	3.42
Extra Heavy Weight									
4″ Short Inlet*	2.59	2.71	2.83	2.95	3.07	3.19	3.31	3.43	3.54
4″ Long Inlet**	3.12	3.24	3.36	3.48	3.60	3.72	3.84	3.96	4.08

*Short inlets are 5½″ long; the pipe used weighs 6 lbs. per running foot.
**Long inlets are 9¾″ long; the pipe used weighs 8 lbs. per running foot.

COMBINATION (LEAD AND IRON) FERRULES

U. S. STANDARD PRICE LIST

	Lengths (In Inches)													
Standard Weight	4	4½	5	6	8	10	12	14	16	18	20	24	30	36
1¼″ for 2″ Cast Iron Pipe		$0.28	$0.36	$0.43	$0.51	$0.60	$0.67	$0.80	$0.90	$1.00	$1.10	$1.30	$1.40	$1.65
1½″ for 2″ Cast Iron Pipe		.28	.36	.43	.51	.60	.67	.80	.90	1.00	1.10	1.30		
2″ for 2″ Cast Iron Pipe	$0.28		.41	.46	.57	.67	.76	.80	.86	.92	1.00	1.15	1.40	1.65
3″ for 3″ Cast Iron Pipe	.42		.60	.67	.82	.98	1.10	1.15	1.22	1.30	1.40	1.60	2.00	2.30
4″ for 4″ Cast Iron Pipe	.50		.72	.85	1.02	1.25	1.40	1.60	1.73	1.85	2.10	2.30	2.75	3.25
Extra Heavy Weight														
1½″ for 2″ Cast Iron Pipe		.38	.44	.52	.61	.72	.80	1.15	1.30	1.45	1.60	1.90		
2″ for 2″ Cast Iron Pipe	.42		.49	.54	.67	.81	.93	1.10	1.23	1.36	1.49	1.75	2.20	2.60
3″ for 3″ Cast Iron Pipe	.55		.75	.84	1.00	1.18	1.35	1.46	1.63	1.80	1.97	2.33	2.90	3.40
4″ for 4″ Cast Iron Pipe	.70		.84	.94	1.23	1.45	1.67	2.00	2.21	2.45	2.70	3.16	3.76	4.36

STOCK PACKAGES

A Full Barrel of 1¼″ or 1½″ x 2″ Contains		160	160	160	120	80	80	See Note A	32	32	See Note A
A Full Barrel of 2″ Contains	200		160	160	120	80	80	See Note A	32	32	See Note A
A Full Barrel of 3″ Contains	100		80	80	60	40	40	See Note A	15	15	See Note A
A Full Barrel of 4″ Contains	72		50	50	38	25	25	See Note A	10	10	See Note A and B

Note A: Ferrules 14″, 16″, 18″, 30″ or 36″ in length are packed in boxes containing 12 or 24 pieces to the box.
Note B: Any barrel of 4″ ferrules may be packed to carry an equal number of 3″, 2″ or 1½″ nested within the 4″.

ACCESSORIES

U. S. STANDARD PRICE LIST

Diameter	1¼″	1½″	2″	3″	4″	5″	6″
Iron Thimbles for Ferrules, each			$0.15	$0.20	$0.25		$0.75
Brass Thimbles for Ferrules, each			.38	.70	1.00		
Brass Spuds for Soldering Nipples, each	$0.20	$0.25	.45	.75	1.00		

COMBINATION (Lead and Brass) SOLDERING NIPPLES

All brass parts on our combination bends and soldering nipples are accurately made from the finest quality metal. The lead portion is extruded and the two joined together in a neat, workmanlike manner.

COMBINATION (LEAD AND BRASS) SOLDERING NIPPLES

U. S. STANDARD PRICE LIST

Length—In Inches	4	5	6	8	10	12	14	16	18	20	24	30	36
Standard Weight													
1¼″ for 1¼″ Iron Pipe	$0.39	$0.42	$0.44	$0.52	$0.58	$0.63	$0.73	$0.78	$0.83	$0.90	$1.00	$1.20	$1.30
1½″ for 1½″ Iron Pipe	.48	.55	.60	.66	.74	.80	.93	1.00	1.07	1.15	1.30	1.48	1.65
2″ for 2″ Iron Pipe	.72	.81	.86	.96	1.08	1.17	1.37	1.47	1.56	1.68	1.87	2.27	2.58
3″ for 3″ Iron Pipe	1.26	1.43	1.50	1.67	1.86	2.00	2.27	2.41	2.56	2.70	3.00	3.53	4.00
4″ for 4″ Iron Pipe	1.63	1.84	1.95	2.13	2.36	2.53	2.93	3.10	3.27	3.45	3.80	4.35	4.92
Extra Heavy Weight													
1¼″ for 1¼″ Iron Pipe	.41	.45	.48	.56	.64	.71	.79	.86	.93	1.00	1.15	1.37	1.60
1½″ for 1½″ Iron Pipe	.51	.56	.60	.71	.82	.92	1.04	1.14	1.24	1.34	1.55	1.85	2.15
2″ for 2″ Iron Pipe	.79	.85	.90	1.04	1.18	1.31	1.47	1.60	1.72	1.85	2.12	2.52	2.92
4″ for 4″ Iron Pipe	1.70	1.95	2.15	2.35	2.55	2.75	3.15	3.35	3.55	3.75	4.25	4.75	5.70

COMBINATION (LEAD AND BRASS) BENDS AND SOLDERING NIPPLES

U. S. STANDARD PRICE LIST

Length of Outlet	12″ or Less	13″	14″	15″	16″	17″	18″	19″	20″
Standard Weight									
1¼″—Short Inlet	$0.79	$0.82	$0.86	$0.86	$0.89	$0.93	$0.94	$0.97	$0.99
—Long Inlet	.85	.88	.92	.93	.96	1.00	1.01	1.04	1.06
1½″—Short Inlet	1.04	1.09	1.13	1.15	1.20	1.24	1.25	1.30	1.32
—Long Inlet	1.15	1.20	1.24	1.25	1.30	1.34	1.36	1.41	1.43
2″ —Short Inlet	1.51	1.57	1.64	1.66	1.72	1.79	1.81	1.87	1.91
—Long Inlet	1.71	1.77	1.84	1.86	1.92	1.99	2.01	2.07	2.11
3″ —Short Inlet	2.65	2.76	2.87	2.91	3.02	3.13	3.16	3.27	3.33
—Long Inlet	2.99	3.10	3.21	3.25	3.36	3.47	3.50	3.61	3.68
4″ —Short Inlet	3.33	3.45	3.57	3.63	3.75	3.87	3.93	4.05	4.11
—Long Inlet	3.78	3.90	4.02	4.07	4.19	4.31	4.36	4.48	4.55
Extra Heavy Weight									
1¼″—Short Inlet	.99	1.04	1.09	1.11	1.16	1.21	1.23	1.28	1.31
—Long Inlet	1.09	1.14	1.19	1.21	1.26	1.31	1.33	1.38	1.41
1½″—Short Inlet	1.38	1.45	1.52	1.55	1.62	1.69	1.72	1.79	1.83
—Long Inlet	1.55	1.62	1.69	1.72	1.79	1.86	1.89	1.96	2.00
2″ —Short Inlet	1.80	1.89	1.97	2.00	2.09	2.17	2.21	2.30	2.35
—Long Inlet	2.07	2.16	2.24	2.28	2.37	2.45	2.48	2.56	2.62
3″ —Short Inlet	2.83	2.95	3.07	3.13	3.25	3.37	3.42	3.54	3.61
—Long Inlet	3.22	3.34	3.46	3.51	3.63	3.75	3.80	3.92	4.00
4″ —Short Inlet	3.72	3.87	4.02	4.08	4.23	4.38	4.44	4.59	4.67
—Long Inlet	4.25	4.40	4.55	4.61	4.76	4.91	4.97	5.12	5.21

STOCK PACKAGES OF SOLDERING NIPPLES

Length—In Inches	4	6	8	10	12	20	24
A Full Barrel of 1¼″ Contains	200	200	150	100	100	40	40
A Full Barrel of 1½″ Contains	160	160	120	80	80	30	30
A Full Barrel of 2″ Contains	120	120	90	60	60	20	20
A Full Barrel of 3″ Contains	75	60	45	30	30	15	15
A Full Barrel of 4″ Contains	60	48	36	24	24	10	10

Note: Soldering nipples 14″, 16″, 18″, 30″ or 36″ in length are packed in boxes with 12 or 24 to the box.

SHEET LEAD

Sheet lead is produced by rolling or milling. Its manufacture involves first the casting of large slabs, several inches thick, from pigs of pure lead or a desired lead alloy. These slabs are then rolled, either hot or cold depending upon the composition of the lead, between steel rollers to a specified thickness.

For many years, we have been the nation's leading supplier of high quality sheet lead. Our product is made only from standard accepted brands of prime lead and lead alloys. Every precaution is taken to produce sheet that is precisely as specified with respect to thickness or weight, subject to commercial tolerances.

SIZES AND WEIGHTS

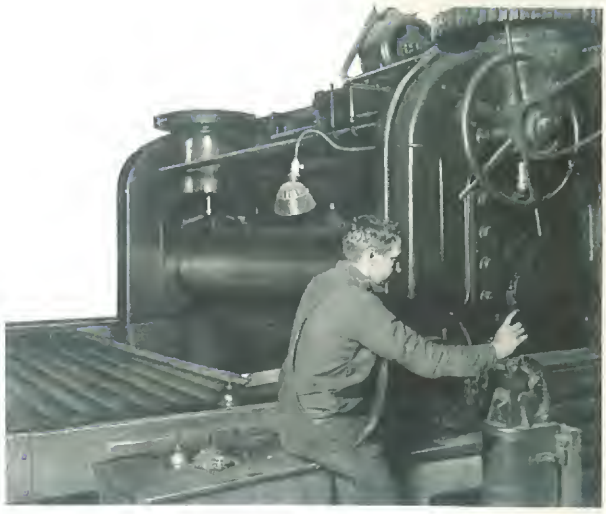
The standard size for milled sheet lead, weighing three pounds per square foot or over, is 8′ wide by 20′ long. The standard size for sheet lead weighing less than three pounds per square foot is 4′ to 5′ wide by 15′ long. However, we are able to furnish sheets on short notice which are considerably larger in width and length than these standard sizes. The maximum sizes are given in the table on the following page.

Sheet lead may be specified either by its weight per square foot or its thickness. There is a rough mathematical correlation between the two. Pure lead sheet weighing one pound per square foot is $\frac{1}{64}$″ thick. Except in the larger sizes, each additional pound per square foot adds $\frac{1}{64}$″ to the thickness.

Commonly used weights of sheet lead are shown in the table on the next page. Other weights per square foot can be rolled on short notice.

DIRECTIONS FOR ORDERING

In ordering sheet lead, specify the type of lead wanted, the weight per square foot or the thickness and the number and size of the sheets. In ordering sheet lead in other than regular stock sizes, please note the following instructions:

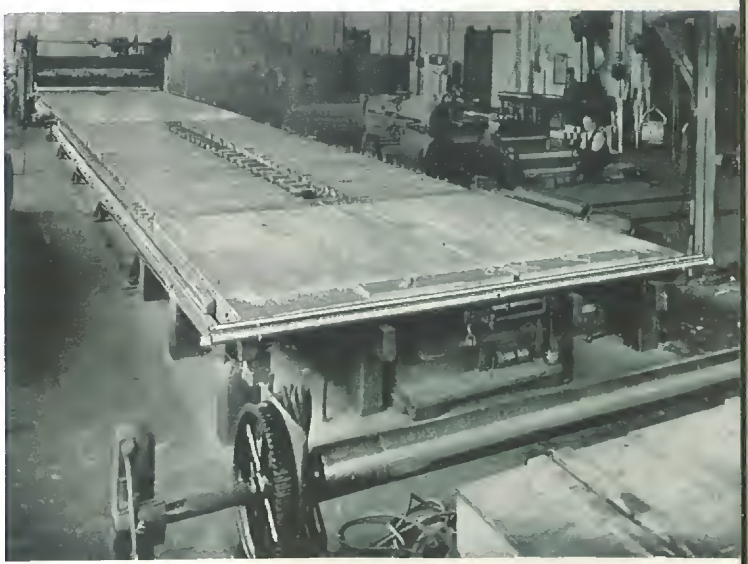


Our care in manufacture insures sheet lead of accurate thickness and weight.

If plain rectangular sheets are wanted, state clearly the width and length. In the case of irregular shape sheets, forward a sketch giving dimensions or send a drawing of the object to be lined or covered, stating clearly all dimensions.

PACKING

Unless otherwise specified, all sheet lead is shipped in rolls which are carefully packed in wooden slats or double-faced corrugated board and fastened with steel straps, wire or rope.



View of a sheet lead rolling mill showing rollers which propel the lead, and cutting table in foreground.

SHEET LEAD SIZES AND WEIGHTS

The weights given below apply to common lead only. Other types of lead, such as antimonial or hard lead, weigh slightly less for a given thickness.

Pounds Per Sq. Ft.	Actual Thickness	App. Thickness in Inches		Maximum Sizes
		Decimal	Fraction	
¾		.0117	1/80	4′x15′
1		.0156	1/64	8′x20′
1½		.0234	3/128	8′x20′
2		.0312	1/32	7′x45′
2½		.0391	5/128	9′x45′
3		.0468	3/64	10′x45′
3½		.0547	7/128	10′x45′
4		.0625	1/16	10′x45′
5		.0781	5/64	10′x43′
6		.0937	3/32	10′x43′, 11′x40′ 11′6″x30′, 11′9″x20
8		.1250	1/8	10′x40′ 11′6″x35′
10		.1563	5/32	11′x40′ 10′x48′
12		.1875	3/16	11′6″x40′ 11′x40′ 11′6″x35′
14		.2188	7/32	11′6″x40′ 11′9″x30′
16		.2500	1/4	11′6″x40′ 11′9″x30′
20		.3333	1/3	11′6″x40′ 11′9″x38′
24		.4000	2/5	11′9″x30′ 11′x34′ 11′6″x32′
30		.5000	1/2	11′x27′ 11′6″x25′6″ 12′x16′
40		.6667	2/3	11′x24′ 12′x16′
60		1.0000	1″	12′x12′

SHEET LEAD
in building construction

Above: *Construction detail of the lead-covered dome of the New Jersey State Reformatory at Rahway, N. J. All seams shown, including those where the sheets join the batten caps, are loose-locked to provide for expansion and contraction.*

Right: *General view of the Reformatory and its lead-covered dome. Nearly 75,000 pounds of sheet lead were required for this job.*

Below: *This photograph shows a lead-covered cornice and through-wall flashing. The cornice covering has been attached to the flashing with a loose-locked seam.*

ROOFING AND FLASHING

One of the most important and, incidentally, one of the oldest uses of sheet lead is for roofing and related building purposes such as flashings, cornice coverings, gutter linings and the like.

Its chief advantage for this purpose is permanence. Lead is non-rusting and more resistant to atmospheric corrosion than any other non-ferrous metal. Consequently, properly installed, sheet lead roofing and flashings rarely require repair or replacement.

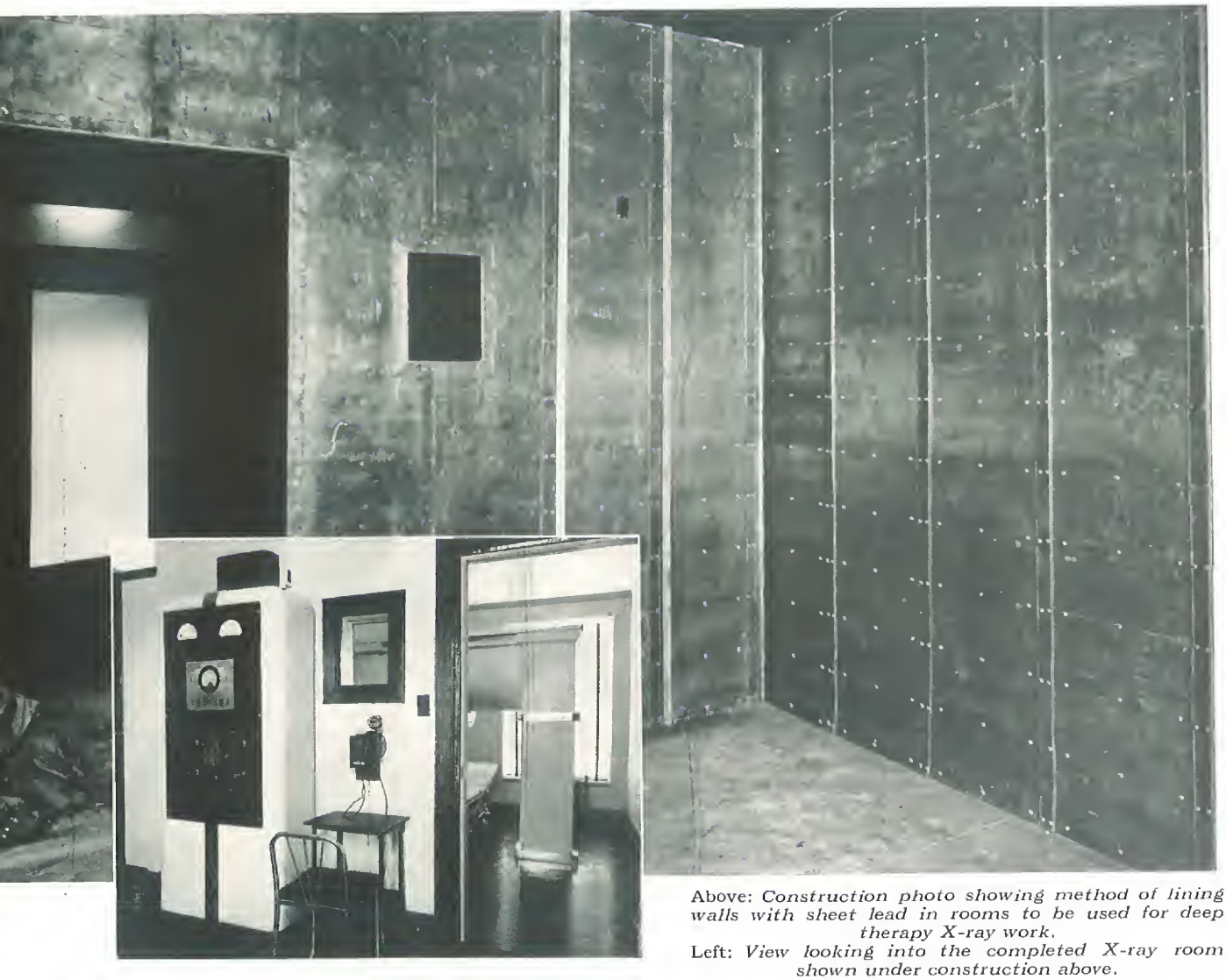
Another advantage lies in appearance. After exposure to the weather, lead takes on a soft, gray patina which goes well with any architectural style. Moreover, lead roofs and flashings do not stain other building materials.

The type of sheet lead most frequently specified for roofing and flashing is hard lead—an alloy of common lead and antimony. The distinct advantage gained by using hard lead lies in the fact that its weight is less than that of soft or common lead for a given thickness. Six per cent antimonial lead is approximately five per cent lighter than

common sheet lead.

The proper weight of sheet lead to use for roofing depends upon the nature of the installation. For gutter linings, cornice coverings, base flashings and roofing purposes generally, three pound sheet is recommended. For cap flashings and batten roofs where the battens are fairly close together, two and one-half pound sheet will suffice.

SHEET LEAD FOR X-RAY EQUIPMENT



Above: *Construction photo showing method of lining walls with sheet lead in rooms to be used for deep therapy X-ray work.*
Left: *View looking into the completed X-ray room shown under construction above.*

A unique characteristic of lead is its ability to absorb short wave length radiations, such as X-rays and radium emanations. Because of this special quality, sheet lead is used extensively for wall and cabinet linings, protective shields and other purposes in hospitals and laboratories where these powerful radiations are handled.

Regarding the use of lead in X-ray rooms, the following excerpts from an article by Singer and Lawrence in "Industrial Radiography" will be of interest.

"The object in planning X-ray protection for any installation is to reduce the X-ray intensity at all positions where personnel will be stationed to a value such that no person will receive more than 0.1r* during any 24-hour period. No hard and fast rules need be laid down for accomplishing this; the

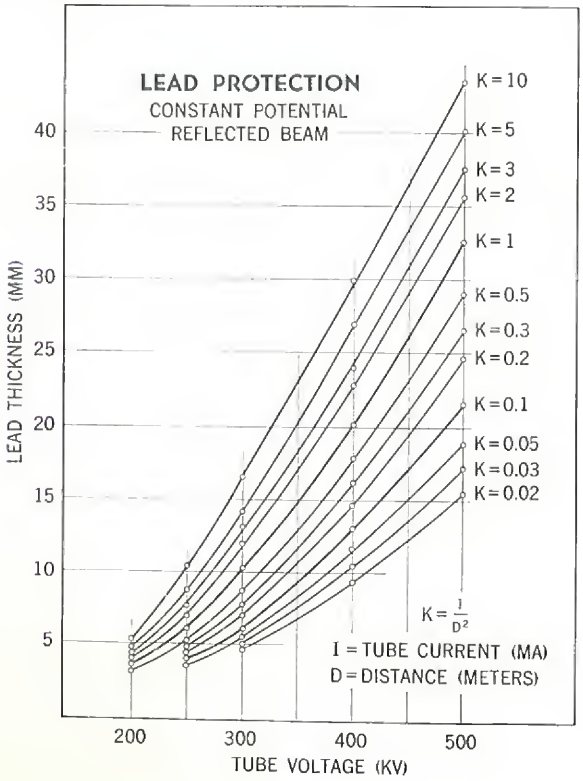
*r = "roentgen," a unit of quantity for X-rays

methods to be used are best left to the ingenuity of those making the plans. Almost any space can be made safe against X-rays by the use of lead or concrete walls of sufficient thickness—in practice such an installation would probably be considered prohibitively expensive, especially when protection against very penetrating radiation is required. The alternative is to consider other methods of protection to be used in addition to radiation barriers. In the interest of economy, full consideration should therefore be given to all three of the following factors: 1. Distance from barrier to X-ray source; 2. Direction of X-ray beam; 3. Radiation barriers."

Following a discussion of distance from barrier to X-ray source, and direction of X-ray beam, the article has this to say about radiation barriers:

"When full advantage has been taken of both distance and tube orientation, it will usually be found that the radiation intensity is still excessive at the control station and in adjacent rooms.

Fig. I. *Lead thickness required for protection against narrow X-ray beams generated by voltages between 200 and 500 KV for various distances between the tube target and operator.*



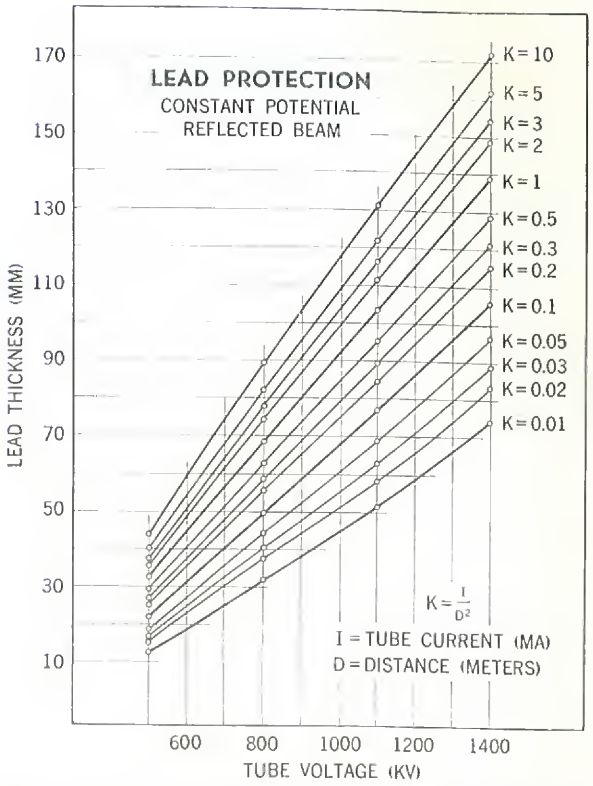


Fig. II. *Lead thickness required for protection against narrow X-ray beams generated by voltages between 500 and 1400 KV for various distances between the tube target and operator.*

Thought must then be given to protective walls or screens. For X-rays generated by voltage under 250 kilovolts, lead sheet is generally used for this purpose; for more penetrating radiation, concrete is most often chosen. The use of lead sheet in combination with concrete is becoming more common and has much to recommend it. The type of barrier selected is determined by relative cost and convenience.

"Two classes of protective barriers should be distinguished:

1. Barriers against direct radiation—from the tube port, from leaks in the tube housing, and from radiation not absorbed by the tube housing.
2. Barriers against scattered radiation—scattered by the patient, walls of the room, or other irradiated objects.

The scattered radiation is generally less penetrating and less intense than the direct radiation; less protection is, therefore, needed against it."

SHEET LEAD FOR SOUND-DEADENING AND VIBRATION ABSORPTION

Left: *These doors to an N. B. C. broadcasting studio, made from layers of wood and sheet lead, are said to reduce noise by an average of 39.56 decibels.*

Above: *Lead "anti-vibration pad" under a grillage in a New York hotel.*

Lead does not ring when struck and is not easily set in vibration. This fact, combined with its mass, accounts for its successful use in deadening sound and vibration.

For vibration absorption, particularly under a building foundation, the sheet lead is usually formed into an "anti-vibration pad". These pads in most cases consist of two layers of eight pound sheet lead enclosing layers of asbestos board, the whole being about an inch thick. Where loads are lighter, smaller pads are used. In some installations merely the sheet lead itself is sufficient.

For sound absorption, construction methods vary. In one installation—a broadcasting studio—the doors are laminated with three layers of wood and two layers of four pound sheet lead. In another, four pound sheet lead lines the walls, floor and ceiling of a laboratory interior.

SHEET LEAD FOR SHOWER BATH PANS

This sheet lead shower pan is designed for a three-shower installation. It will provide positive and permanent waterproofing.

In the Rome of antiquity, baths were lined with sheet lead to keep them water-tight. For the same reason, many modern shower stalls have a lead pan at the base to keep water from seeping through the floor.

Lead shower pans are easy to install and per-

manent. The sheet lead dresses down evenly over the surface to be covered, leaving no voids to permit later settlement and possible damage to the finished tile floor. It is not damaged by building movement and permanently protects against the seepage of moisture.

For shower stall installation, six pound sheet lead is the usual specification. When placed in contact with concrete or mortar, the lead is painted with asphaltum or coated with tar to protect it during the initial period against attack by the fresh lime contained in those materials. Lead in contact with cinders should be similarly treated.

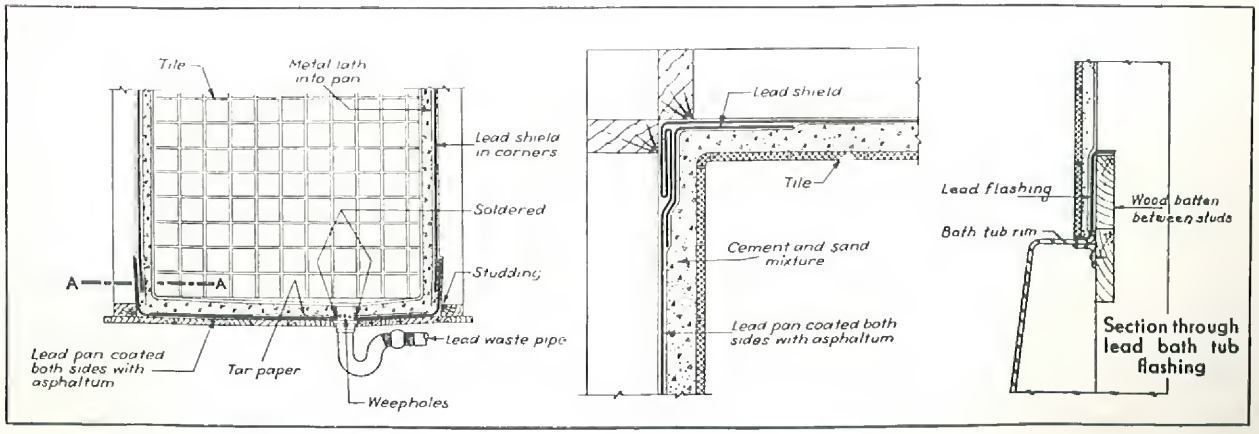
SHOWER PAN INSTALLATION

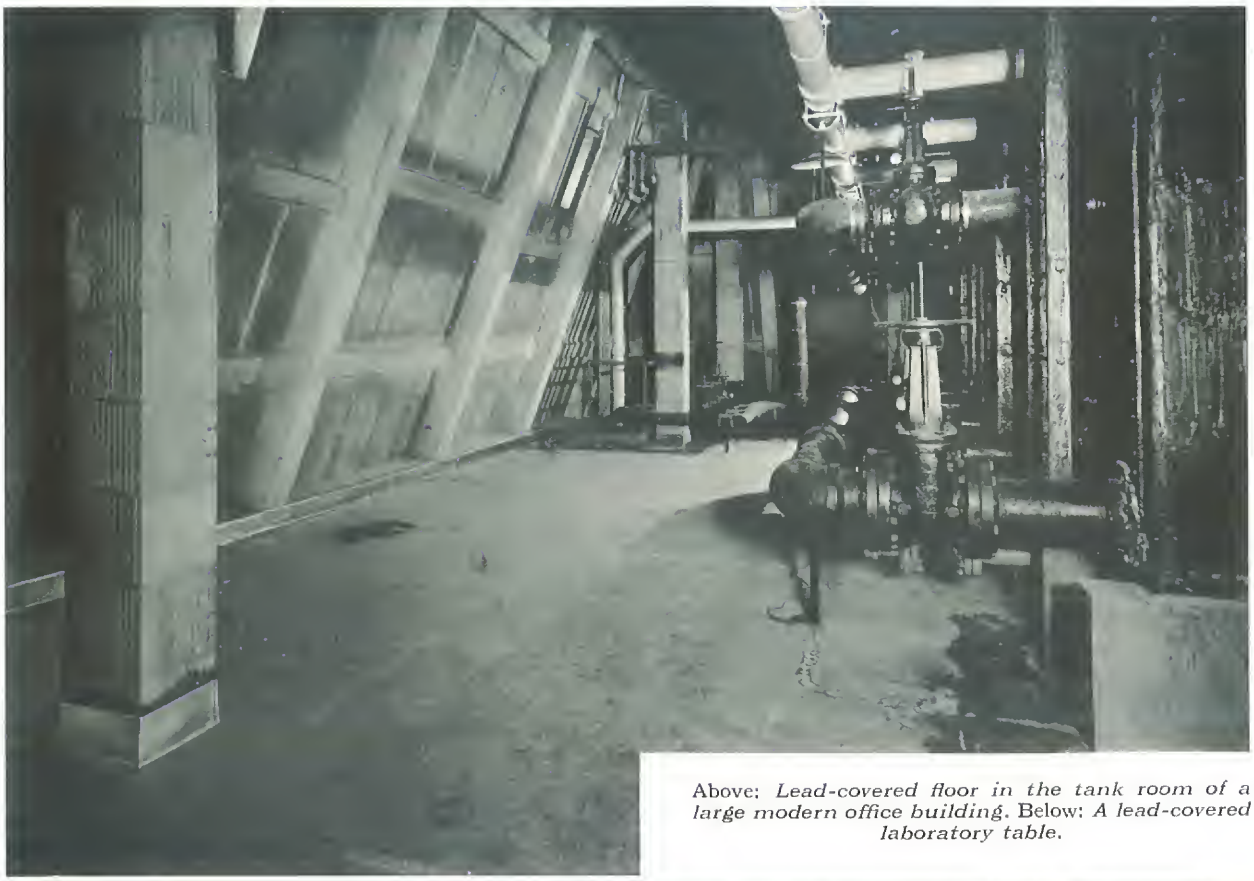
The following directions should be observed in installing lead shower pans:

1. Use 4 to 6 lb. lead—the heavier weight being preferable.
2. Cut the sheet to the size and shape of the shower stall, allowing 6 in. for turn-up all around and cutting a hole to receive the drain.
3. Chalk mark the stall area centered on the sheet, less $\frac{3}{8}$ in. to allow for the bend and thickness of the lead.
4. Place a 2 in. by 4 in. along the chalk marks and dress the upstands into position. Placing the dresser on edge on the chalk lines and striking with the mallet facilitates bending.
5. Fold the corners tight to the sides and solder or burn the corner seam.
6. Notch studs back $\frac{1}{4}$ in. for the height of the upstands so they will set back and catch any leakage through the tile above.
7. If installed on concrete, coat both sides of the lead pan with asphaltum, including upstands. If installed on wood, place a layer of asphalt-saturated building paper under the pan and coat the inside and upstands with asphaltum. This simple precaution will protect the lead from possible attack by water seeping through green cement, concrete or mortar during the initial period before these materials have become carbonated.
8. Install the pan and countersink the trap flange to assure drainage. Be sure the joint at the drain is tight.
9. Flash the corners of the stall with strips of lead 6 in. wide and at least 5 ft. high with the lower end inside the upstand of the pan. This will prevent leakage at the corners.
10. Plug the trap and fill the pan with water as a test before the tile is installed.

Rims of tubs with showers over them should be flashed with lead as shown in the small sketch.

Elevation and plan of a lead shower pan installation with corner flashing. Sketch at right shows method of flashing rims of bath tubs having overhead showers.



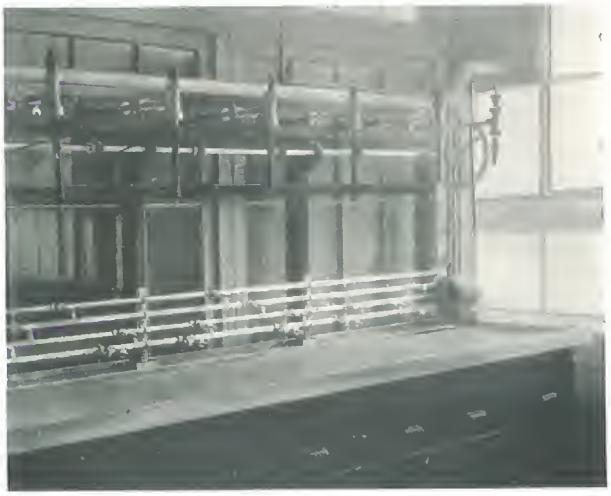


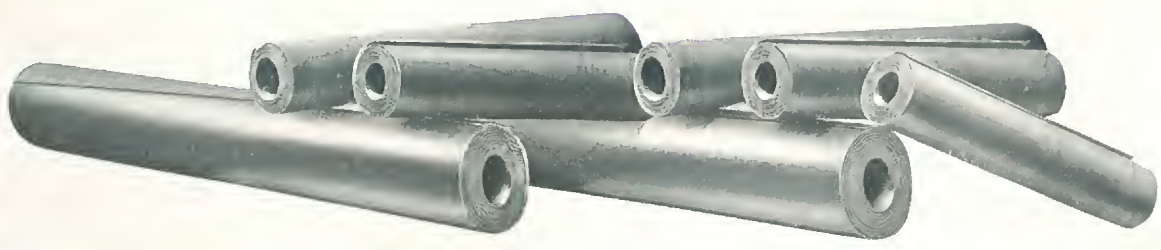
Above: *Lead-covered floor in the tank room of a large modern office building.* Below: *A lead-covered laboratory table.*

FLOORS AND TABLE TOPS

An interesting, although a rather specialized use of sheet lead is as a covering for floors and table tops in laboratories, hospitals and industrial plants.

Lead flooring has been found to give better and longer service where corrosive substances are handled. It has also been used successfully in plants handling inflammables or explosives where it tends to prevent sparking. Lead table tops for industrial laboratories, besides being non-corrosive, are said to reduce the breakage of glassware.





SOLDER

Solder is used in practically all trades and industries for the joining of metals such as tin, lead, copper, copper alloys, nickel, monel metal, iron, steel and stainless steel.

Soldering differs from welding in several respects. One of the chief distinctions between them is that in soldering, the metals to be joined are not heated to their melting points. Consequently, one of the requisites for a solder is that its melting point be lower than those of the metals it unites. Solder joins largely through its ability to adhere readily to the properly cleaned surfaces of other metals.

To insure adhesion in soldering, fluxes are necessary. Mild fluxes such as rosin, tallow or grease principally prevent oxidation of the metals being joined due to contact with the air or the hot solder. Active fluxes such as zinc chloride or some other chemical solution dissolve oxides already formed.

COMPOSITION

Solder is composed principally of lead and tin. Regardless of the proportions, it has a lower melting point than lead. When the tin content is 42½% or higher, it also has a lower melting point than tin.

When heated, solder does not change immediately from a solid to a liquid (except in the case of the eutectic alloy 62% tin—38% lead) but passes through an intermediate semi-liquid state. By varying the proportions of lead and tin, solders of differing melting points and tensile strengths, and ranging from extreme fluidity to sluggishness during the semi-liquid state, are obtained.

Occasionally small quantities of other metals are added to solder to produce hardness, greater strength, brightness, a very low fusing point or some other special quality. The proper alloying of these other metals with lead and tin requires a high degree of manufacturing skill. Their presence in any considerable quantity in the average solder is usually considered a defect.

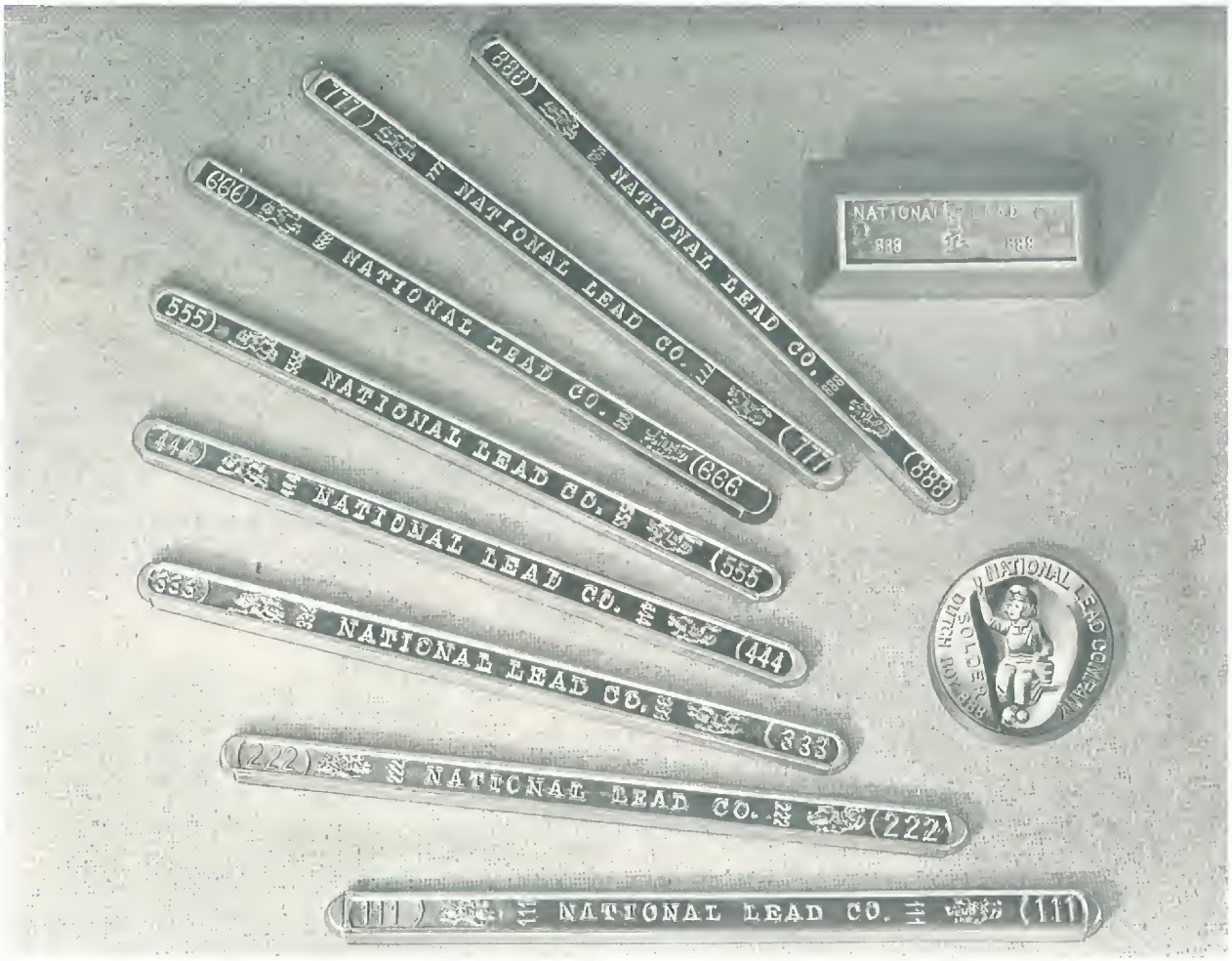
Above: *Pouring molten solder over a joint in a lead-covered telephone cable. As the solder cools to a plastic state, it is molded to shape with the "catch cloth."*

Below: *Finishing a wiped joint in lead pipe.*

SELECTION OF SOLDER

The selection of a solder depends largely on the method by which it will be applied, i.e. whether by wiping, sweating or the use of a blow-torch, soldering iron or solder bath. The method of application is, in turn, determined by the type of assembly, the character of the metals to be joined, their size and position, the speed with which the operation must be completed and the shape, strength and appearance required in the finished work.

Where the buyer does not have past experience to guide the selection or where doubts exist as to the suitability and economy of the solder now being used, the technical staff of National Lead Company will be glad to recommend the proper grade of solder to use.



OUR LINE OF SOLDER

We manufacture under the "Dutch Boy" trademark a complete line of solder, designed to meet a wide range of requirements. In addition to the bar solders shown above, the line includes numerous other solders of various shapes and compositions to meet all soldering needs. These are described on the following pages. We also manufacture solder without our trademark in practically any form or of any composition specified by the user.

All solders we manufacture are guaranteed to be made only from pure, clean metals, carefully alloyed to insure uniformity. They are free of foreign substances tending to produce brittleness, discoloration or lack of adhesion.

DUTCH BOY* BAR SOLDER

Dutch Boy bar solder is available in eight grades—each one of which is suitable for certain kinds of work and is designated by number. The grades with the lowest numerical designation contain the most tin.

DUTCH BOY 111

This is the highest grade solder sold under the Dutch Boy trademark. It is guaranteed to be made of new lead and new tin, carefully mixed in equal parts (50% tin and 50% lead). Its melting range is 361°F–421°F.

Dutch Boy 111 is bright, strong and free from impurities. It flows easily, covers more area and has superior adhesion. It is widely used for new roofing work and is popular among tinsmiths, manufacturers and canners. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 222

Dutch Boy 222 is a smooth, free-flowing solder which contains slightly less tin than Dutch Boy 111. Its melting range is 361°F–432°F. It can be used wherever a bright, strong solder is wanted. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 333

Dutch Boy 333 is a composition suitable and popular for the general run of galvanized iron and sheet metal work, roofing and cornices. Its melting range is 363°F–441°F. It flows freely. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 444

Dutch Boy 444 is a grade of solder which is known to the trade under the brand "Strictly Half and Half" although it actually contains more lead than tin. With a melting range of 363°F–435°F, Dutch Boy 444 is useful for heavy seamed work and is sometimes used for the reduction of better grades of solder. Sold in bars weighing approximately 1½ lbs.

* Trade Mark Reg. U. S. Pat. Off.

DUTCH BOY 555

Dutch Boy 555 is suitable for many special requirements and is particularly adapted for plumbing work where a bright showy job is required. It can be used with an iron. Dutch Boy 555 has a melting range of 363°F–448°F. It is sold in bars weighing approximately 1½ lbs. and rectangular ingots weighing 5 lbs.

Above: *Solder being cast into bars.* Below: *Bars being removed from mold. Imperfect bars are discarded.*

DUTCH BOY 666

Dutch Boy 666, with a melting range of 363°F–450°F, flows freely but not quite as well as the finer grades. In electrical construction, tin can factories and for work of a similar character, it is the most thoroughly reliable and economical solder that can

be used. It is also a first-class dipping solder. Sold in bars weighing approximately 1 ½ lbs. and ingots weighing 5 lbs.

DUTCH BOY 777

Dutch Boy 777 contains an unusually large percentage of tin for solder of this grade. It has a melting range of 363°F–450°F. When used by plumbers for wiping it can be reduced slightly with more lead. Sold in bars weighing approximately 1 ½ lbs. and ingots weighing 5 lbs.

DUTCH BOY 888

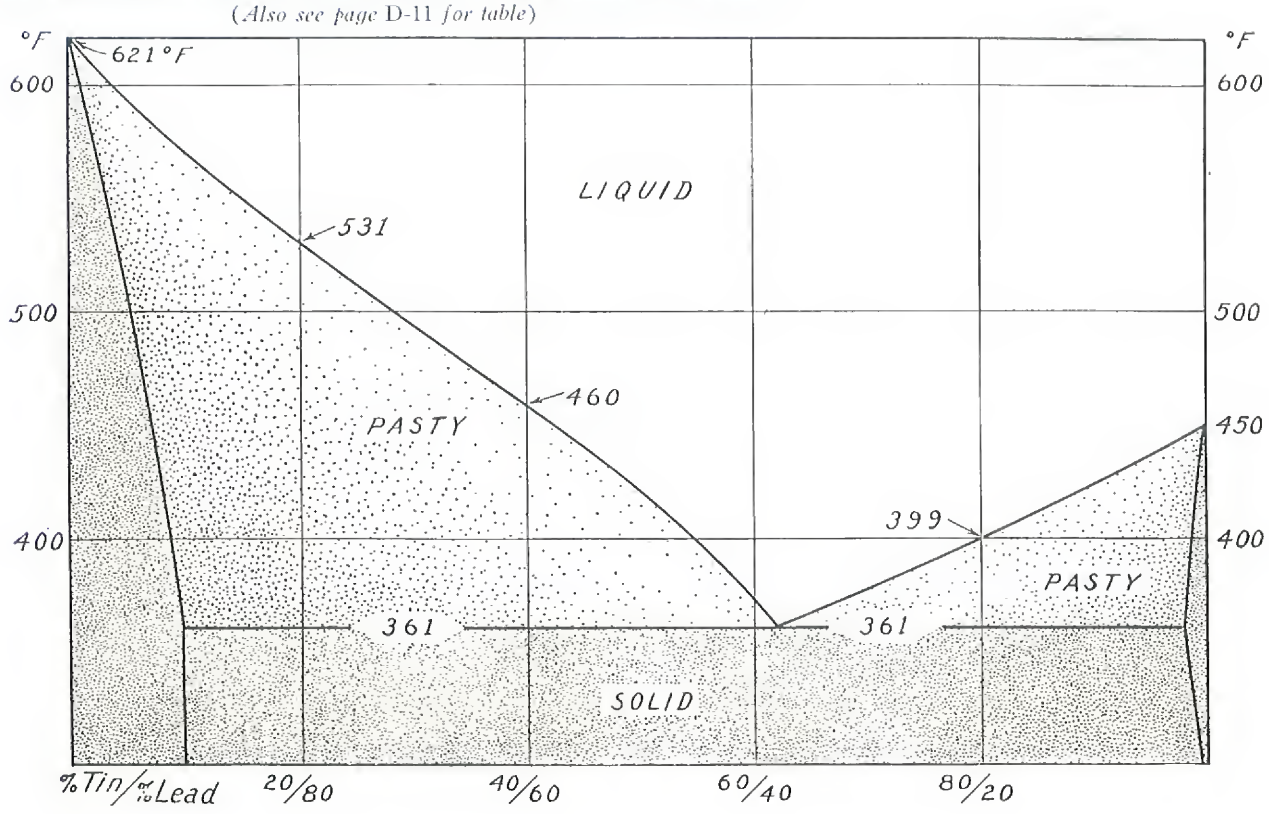
Dutch Boy 888 is strictly a plumber's solder. It wipes a joint that will not sweat unless the solder is doped too heavily with lead. It has a melting range of 361°F–453°F and is sold in 1 ½ lb. bars and ingots weighing approximately 3 lbs.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF DUTCH BOY SOLDERS

No.	Ultimate Tensile Strength lbs./sq. in.	Elongation %	Shear Strength lbs./sq. in.	Impact Strength (Izod) ft. lbs.	Brinell Hardness No.	Specific Gravity	Liquidus		Solidus	
							Cent.	Fahr.	Cent.	Fahr.
111	6450	90	5800	15.4	12.3	8.85	216	421	183	361
222	6600	90	5700	15.4	12.3	8.92	222	432	183	361
333	6400	90	5500	15.1	12.2	9.04	227	441	184	363
444	6600	90	5625	15.2	12.7	9.02	224	435	184	363
555	6700	90	5525	14.8	12.7	9.11	231	448	184	363
666	7000	80	5450	14.5	13.4	9.19	232	450	184	363
777	7000	75	5375	14.3	13.3	9.24	232	450	184	363
888	7000	70	5275	13.7	13.3	9.33	234	453	183	361

MELTING CHARACTERISTICS OF TIN-LEAD ALLOYS

(*Also see page* D-11 *for table*)



DUTCH BOY FLUXRITE* WIRE SOLDER

A fluxed wire solder made on a new principle. In Fluxrite the flux is enclosed in several parallel grooves running along the surface of the wire rather than in one central channel like conventional fluxed wire solder. Fluxrite thus has the advantage of automatically applying the flux first to the work, an important point in efficient soldering. With Fluxrite, the wire is heated, the flux is released to cover the work and then the solder melts to complete the job.

Fluxrite can be supplied with rosin or acid flux as well as with certain of the intermediate neutral types of fluxes, and comes in a wide range of compositions and diameters. It can also be furnished in special shapes to fit specific jobs. Fluxrite is ideal for all types of electrical, telephone and radio work. It has proved very successful in soldering operations involving induction heating. It has also been used very successfully in conjunction with stream-lined sweated copper fittings and pipe.

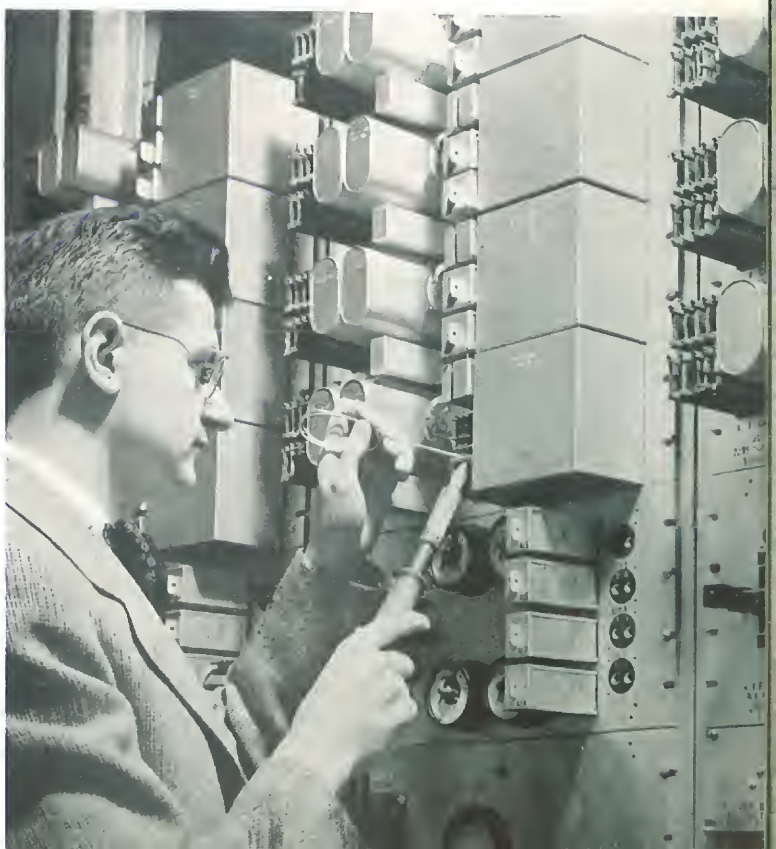
Dutch Boy Fluxrite Wire Solder is stocked in the same diameters and on the same weight spools as conventional wire solder. Other sizes from $\frac{5}{32}$" to $\frac{1}{64}$", as well as special gauges, can be furnished promptly on special order.

DUTCH BOY FLUX CORE SOLDER

Dutch Boy Flux Core Solder is hollow solder wire filled with either an acid flux or a rosin flux. The former is suitable for general work wherever wire solder is considered the best form to use. The

Right: *Soldering a terminal wire on an oscillator for voice frequency carrier telegraphy. For soldering work of this type, rosin flux core solder—furnishing solder and flux simultaneously—is ideal.*

Courtesy Bell Telephone Laboratories



*Trade Mark Reg. U.S. Pat. Off.

latter is especially fine for electrical work, including radio.

Both Dutch Boy Rosin-Core Wire Solder and Dutch Boy Acid-Core Wire Solder are supplied in three sizes—⅛", 5/64" and 1/16". They are furnished on 1, 5, 10, 15, 25 and 50 lb. spools.

AUTO BODY SOLDER

This grade is a special solder designed for auto repair work. Containing only pure, clean tin and lead, it has the pastiness necessary for the proper filling of dents but will not run. It contains no hard spots, molds smoothly under a paddle and can be worked readily into narrow crevices and scores. The finished work will be tough and strong.

Auto Body Solder is furnished in 4 or 8-ounce bars. The latter are ⅜" square and 13" long. Both are packed in 25 lb. cartons. It can also be supplied in 1½ lb. bars, packed in 50 lb., 100 lb. or 250 lb. boxes, or in ¼" round wire form cut in 13" strips for use in solder spray guns. The strips are packed in 25 lb. cartons.

NITON ALLOY

A special alloy developed for use in place of tin-bearing auto body solders. Sold in oval bar form, extruded, not cast. Put up in 100 lb. net weight cartons.

DUTCH BOY TINNING COMPOUND

This is a real time and labor saver on auto body repair work. Its use does away with the need for preliminary removal of surface coatings. The area to be repaired is heated, the Tinning Compound is rubbed on with a wad of steel wool and the heat from the blow-torch and the ingredients in the compound do the preparatory work of cleaning and tinning the affected area, ready to take the solder.

This compound is also ideal for tinning bearing shells—it produces quickly and simply a well-tinned surface that bonds perfectly with shell and bearing metal.

Dutch Boy Tinning Compound is put up in one-lb. net weight containers only.

STAINLESS STEEL SOLDER

This solder has exceptional tinning and wetting characteristics and low fusion temperature to avoid buckling of sheet metal. Makes strongest possible joint. Supplied in wire form or in 8-ounce and 1½ pound bars.

PECOS SOLDER

This low-tin solder is a specially formulated alloy that has met with wide acceptance because it has working qualities comparable with solders of a much higher tin content.

Pecos is fast tinning and fast wetting. While it has a higher liquidus point than a solder rich in tin, it applies more readily than the usual low tin solder. This minimizes oxidation and fouling of soldering irons.

Pecos solder is furnished in 8 oz. bars ¼" x 5/16" x 12", packed 100 lbs. to the case. Also supplied in wire form, 1 lb., 5 lb. and 50 lb. spools.

SILVER CONTENT SOLDER

National Lead Company has developed several solders of a tin-lead-silver combination. The addition of silver in carefully regulated proportions gives these solders certain qualities that make them ideal for many specialized uses. They have met with enthusiastic reception by important solder users.

These special solders are not to be confused with the wartime solders where silver was used to replace tin and which were sometimes difficult to handle and uncertain in their actions. All of the National Lead solders have been well tested in practice and will be found thoroughly reliable and easy to use.

Information about silver content solder that will meet your particular requirements will be gladly furnished upon request.

Torch soldering operation on autotruck radiator.

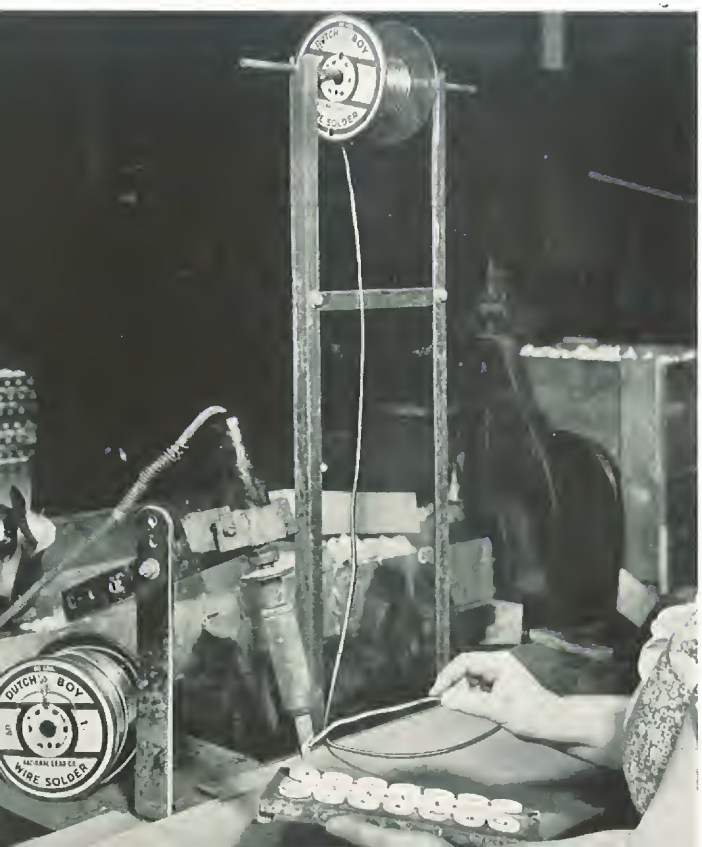
Soldering by the induction heating method. The assembled parts with solder preplaced go on conveyor belt at right, then pass between induction heating elements (center) where the soldering operation takes place in a matter of seconds. Completed unit is at extreme left. Courtesy American Transformer Co.

LEAD, TIN, AND SOLDER WIRE SPECIFICATIONS

(Birmingham or Stubs Gauge)

Number of Wire Gauge	Diameter Inch	Area Sq. In.	Lead		Tin		50-50 Solder		4% Antimonial Lead	
			Lb. per 100 Ft.	Ft. per Lb.	Lb. per 100 Ft.	Ft. per Lb.	Lb. per 100 Ft.	Ft. per Lb.	Lb. per 100 Ft.	Ft. Per Lb.
31	.010	.00008	.04	2564	.03	4000	.03	3245	.04	2632
30	.012	.00011	.05	1852	.04	2857	.04	2360	.05	1887
29	.013	.00013	.06	1563	.04	2439	.05	1997	.06	1613
28	.014	.00015	.07	1351	.05	2083	.06	1731	.07	1389
27	.016	.00020	.10	1020	.06	1587	.08	1298	.10	1042
26	.018	.00025	.12	813	.08	1266	.10	1038	.12	840
25	.020	.00031	.15	658	.10	1020	.12	838	.15	676
24	.022	.00038	.19	538	.12	833	.15	683	.18	553
23	.025	.00049	.24	417	.16	645	.19	530	.23	427
22	.028	.00062	.30	329	.20	510	.24	419	.30	338
21	.032	.00080	.39	255	.25	395	.31	325	.38	262
20	.035	.00096	.47	213	.30	329	.37	270	.46	218
19	.042	.00139	.68	147	.44	227	.54	187	.66	151
18	.049	.00189	.93	108	.60	167	.73	137	.90	111
17	.058	.00264	1.29	77.3	.84	120	1.02	98.3	1.26	79.3
16	.065	.00332	1.63	61.5	1.05	95.1	1.28	78.2	1.59	63.1
15	.072	.00407	1.99	50.2	1.29	77.6	1.57	63.8	1.94	51.4
14	.083	.00541	2.65	37.7	1.71	58.3	2.08	48.0	2.58	38.7
13	.095	.00709	3.47	28.8	2.25	44.5	2.73	36.6	3.39	29.5
12	.109	.00933	4.57	21.9	2.96	33.8	3.59	27.8	4.46	22.4
11	.120	.01131	5.54	18.0	3.58	27.9	4.36	23.0	5.40	18.5
10	.134	.01410	6.91	14.5	4.47	22.4	5.43	18.4	6.73	14.9
9	.148	.01720	8.43	11.9	5.45	18.4	6.63	15.1	8.22	12.2
8	.165	.02138	10.5	9.55	6.77	14.8	8.24	12.1	10.2	9.79
7	.180	.02545	12.5	8.02	8.06	12.4	9.80	10.2	12.2	8.23
6	.203	.03237	15.9	6.30	10.3	9.75	12.5	8.02	15.5	6.47
5	.220	.03801	18.6	5.37	12.0	8.30	14.6	6.83	18.2	5.51
4	.238	.04449	21.8	4.59	14.1	7.10	17.1	5.83	21.3	4.71
3	.259	.05269	25.8	3.87	16.7	5.99	20.3	4.93	25.2	3.97
2	.284	.06335	31.0	3.22	20.1	4.98	24.4	4.10	30.3	3.31
1	.300	.07069	34.6	2.89	22.4	4.47	27.2	3.67	33.8	2.96

SPECIAL SOLDERS



In addition to the solders shown on the preceding pages which are designed in composition and shape to meet average requirements, we manufacture solder in practically any form desired by

Left: Soldering fuses with Dutch Boy wire solder. To insure continuous operation, the soldering iron is kept at the correct temperature by an electrical heating element.

Courtesy Metropolitan Electric Mfg. Co.

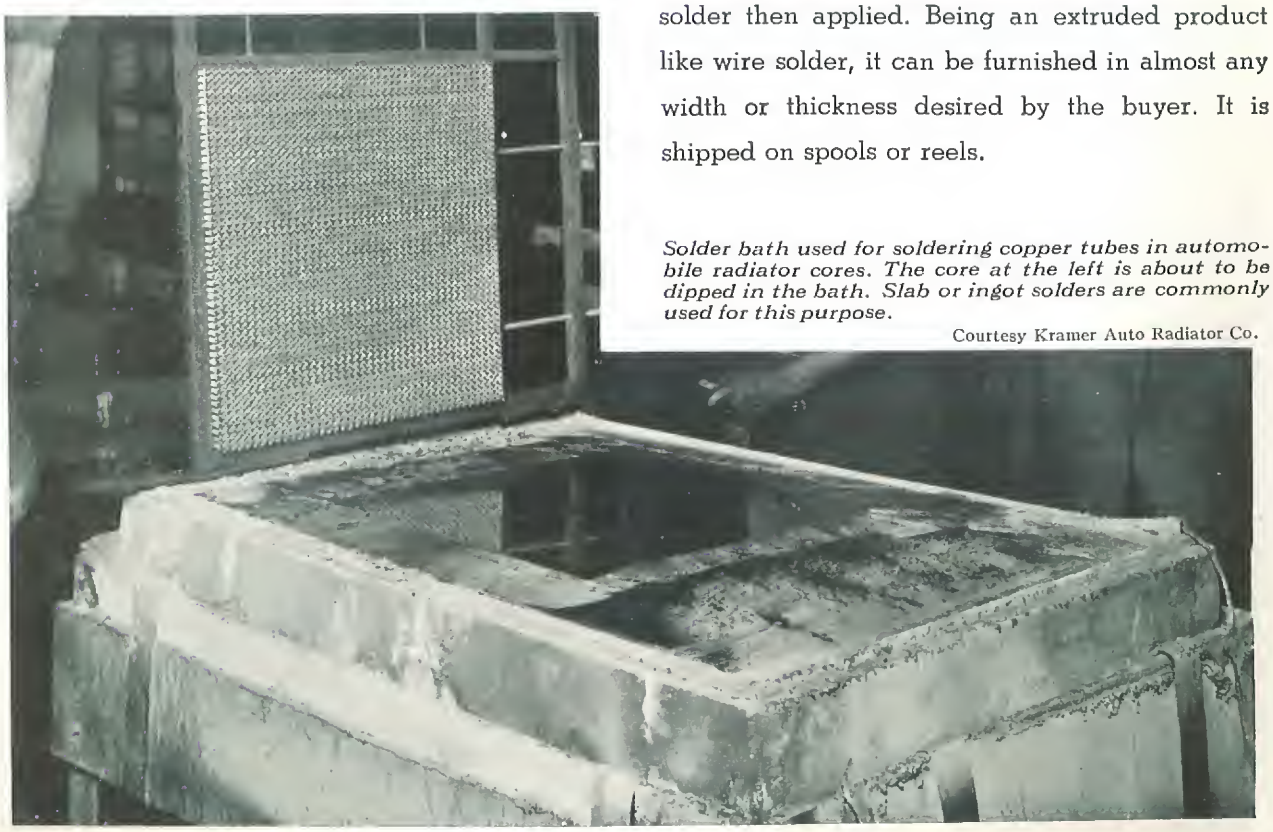
the user and alloyed according to any specified formula. A number of frequently specified types are described on the following pages.

Because of the great variety of shapes and compositions which may be supplied, special solders—with the exception of the more commonly used forms of solder wire—are not ordinarily kept in stock. However, our facilities for manufacturing solder are so complete that any order can be filled promptly. The photo at the right shows most of the forms in which our solders are supplied—sheet, slab, thin bar, tape or ribbon, pulverized, wire, drop and segment.

Wire Solder—Wire solder is produced by an extrusion process. It can be supplied in practically any desired diameter from 1/40" to 29/64" and of any specified composition.

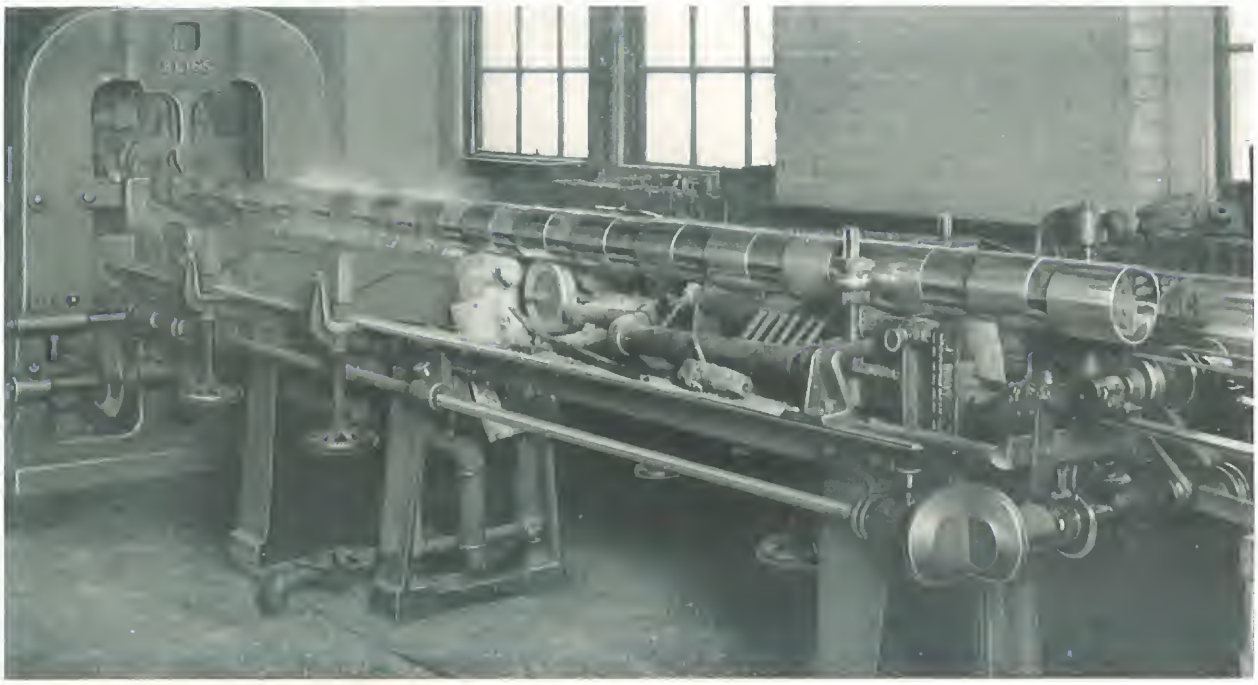
Our wire solder is carefully made to insure uniformity in gauge throughout the entire length. It is furnished on 1, 5, 10, 25, 50 and 65 lb. spools, or, if specified, in 5, 10, or 25 lb. coils, or, cut into segments. In ordering wire solder, use the gauge table on the preceding page.

Tape or Ribbon Solder—Tape or ribbon solder is commonly used where the parts to be joined are preheated with a blow-torch and the solder then applied. Being an extruded product like wire solder, it can be furnished in almost any width or thickness desired by the buyer. It is shipped on spools or reels.



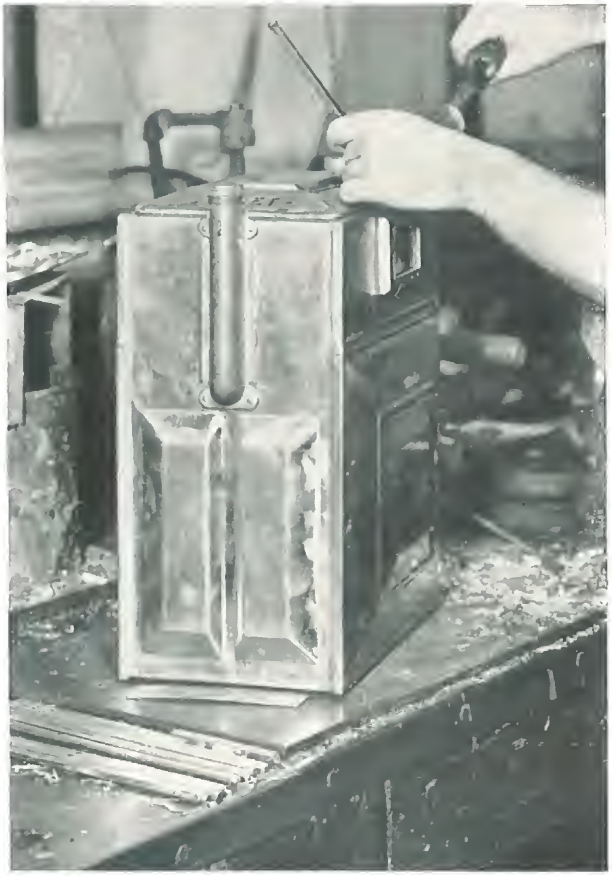
Solder bath used for soldering copper tubes in automobile radiator cores. The core at the left is about to be dipped in the bath. Slab or ingot solders are commonly used for this purpose.

Courtesy Kramer Auto Radiator Co.



Above: *Can soldering machine. As the can bodies leave the forming machine at the extreme left, they pass over the solder bath where short rolls apply solder to the seam.* Below: *Soldering top seam on a gas meter.*

Courtesy Lambert Meter Co



Triangular Bar Solder—Triangular bar solder gets its name from its triangular shape which is found useful in many specialized types of soldering work. The bars usually measure 14″ in length with ¼″, 5/16″ and ⅜″ sides although other sizes are available. This form of solder is either cast or extruded according to the quantity ordered.

Drop Solder—Drop solder is triangular bar solder which has been cut into slices according to the specifications of the buyer. The slices can be cut to practically any thickness desired. When ordering drop solder, state the desired number of drops to the ounce or pound.

Tinner's Bar Solder—Tinner's bar solder is a cast product and is furnished in bars 12″ to 14″ long and usually ½″ to ¾″ wide and ½″ thick. It is a handy bar for soldering seams in certain kinds of tin work.

Meter Bar Solder—Meter bar solder is either cast or extruded according to the size of the order. It is rectangular in shape, usually about 14″ long, ⅜″ to ½″ wide and ¼″ to ⅜″ thick. It derives its name from the fact that it is widely used for seam soldering in the manufacture of gas meters.

Capping Bar Solder—This is a small cast bar

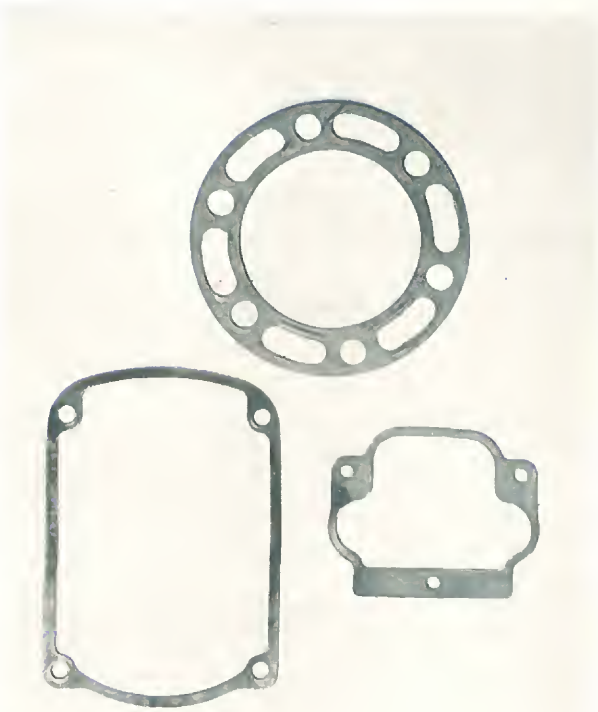
about ¼″ x ¼″ and 12″ long. It is sometimes used by canners in place of drop or segment solder.

Solder Slabs—For solder baths, solder is usually supplied in slab form. The common sizes are 36″ x 3″ x 1″, 24″ x 3″ x ¾″ and 18″ x 3″ x ¾″. They vary in weight from 15 to 35 lbs.

Pulverized Solder — Pulverized solder is useful for fine, delicate soldering work. This form is available in all standard solder compositions and comes in 50, 100 or 200 meshes to the square inch. Special composition alloys and meshes can be supplied on application.

Sheet Solder—Any solder formula is also available in sheet form. The sheets are first cast and then rolled. It is available in sizes not larger than 24″ x 36″ and thicknesses from .010″ to .100″.

Solder Rings and Shapes (Die Cut)—We are prepared to furnish, on special order, sheet solder punched or cut in an unlimited range of sizes and shapes to meet the problem of machine-soldering large quantities of identical parts. Note illustration at right.



MELTING DATA ON TIN-LEAD ALLOYS

Also see chart on page D-4

Composition		Melting Points				Freezing Range		Composition		Melting Points				Freezing Range	
Tin Per Cent	Lead Per Cent	Solidus		Liquidus				Tin Per Cent	Lead Per Cent	Solidus		Liquidus			
		°F	°C	°F	°C	°F	°C			°F	°C	°F	°C	°F	°C
0	100	621	327	621	327	0	0	52.5	47.5	361	183	410	210	49	27
2.5	97.5	574*	301*	606	319	32	18	55.0	45.0	361	183	399	204	38	21
5.0	95.0	518*	270*	594	312	76	42	57.5	42.5	361	183	387	197	26	14
7.5	92.5	450*	232*	581	305	131	73	60.0	40.0	361	183	374	190	13	7
10.0	90.0	361*	183*	570	299	209	116	62.0	38.0	361	183	361	183	0	0
12.5	87.5	361*	183*	559	293	198	110	62.5	37.5	361	183	363	184	2	1
15.0	85.0	361*	183*	550	288	189	105	65.0	35.0	361	183	367	186	6	3
17.5	82.5	361*	183*	540	282	179	99	67.5	32.5	361	183	372	189	11	6
20.0	80.0	361	183	531	277	170	94	70.0	30.0	361	183	378	192	17	9
22.5	77.5	361	183	520	271	159	88	72.5	27.5	361	183	383	195	22	12
25.0	75.0	361	183	511	266	150	83	75.0	25.0	361	183	387	197	26	14
27.5	72.5	361	183	500	260	139	77	77.5	22.5	361	183	394	201	33	18
30.0	70.0	361	183	491	255	130	72	80.0	20.0	361	183	399	204	38	21
32.5	67.5	361	183	484	251	123	68	82.5	17.5	361	183	405	207	44	24
35.0	65.0	361	183	477	247	116	64	85.0	15.0	361	183	410	210	49	27
37.5	62.5	361	183	469	243	108	60	87.5	12.5	361	183	417	214	56	31
40.0	60.0	361	183	460	238	99	55	90.0	10.0	361	183	423	217	62	34
42.5	57.5	361	183	451	233	90	50	92.5	7.5	361	183	428	220	67	37
45.0	55.0	361	183	441	227	80	44	95.0	5.0	361	183	435	224	74	41
47.5	52.5	361	183	432	222	71	39	97.5	2.5	381	194	442	228	81	45
50.0	50.0	361	183	421	216	60	33	100.0	0	450	232	450	232	0	0

*These are preferred values for engineering purposes but are not equilibrium values. At equilibrium the eutectic limits are 19.5–98% tin.

NALCO* SOLDER PAINT

{Nalco Flux No. 11—Acid type.
Nalco Flux No. 12—Rosin type.}

This is a combination of finely-divided solder and flux particles, held in suspension with a special water gel. It is used like a regular paint, being brushed out on the work. Heat is then applied and a brightly tinned surface results. It is a real time saver and a great convenience in electrotype backing, tinning bearing shells, in auto body repair work and in pretinning parts prior to sweat joining.

Nalco Solder Paint stays in suspension in the container and is always ready for use. It has good adhesion and will stay on the area to be soldered even in a vertical position. Preheating is not required.

Nalco Solder Paint is sold in ½, 1, 5 and 50-lb. containers.

LOW-MELTING SOLDERS (FUSIBLE ALLOYS)

Solders and alloys with particularly low-melting points, some even lower than water's boiling point, are included in this classification. They are used where ordinary solders will not do, principally in automatic safety devices, of which sprinkler heads in fire-extinguishing systems are a good example.

Another important field for fusible alloys is in connection with work on materials or objects easily damaged by excess heat, such as wax impregnated radio condensers. These alloys likewise are used to seal glass equipment where a vacuum tight joint is needed, and for joining metals with glass or other vitreous materials.

Low-melting alloys are often employed as molds or patterns, for filling thin-walled tubes so they can be bent and for short run forming dies.

National Lead Company furnishes fusible alloys (low-melting solders) in any desired composition. Some of those in common use are listed below.

Sprinkler head controlled by fusible alloy. Arrow points to soldered joint.

*Trade Mark Reg. U.S. Pat. Off.

COMPOSITION AND MELTING TEMPERATURES FOR SOME LOW-MELTING EUTECTIC ALLOYS

Melting Point °C	Melting Point °F	Composition in Per Cent				
		Bismuth	Lead	Tin	Cadmium	Others
47	117	40.9	22.1	10.7	8.2	18.1 In
70	158	50.0	26.7	13.3	10.0	.....
91.5	197	51.6	40.2	.....	8.2	.....
95	203	52.5	32.0	15.5	.....	.....
102.5	217	54.0	.....	26.0	20.0	.....
124	256	55.5	44.5	.....	.....	.....
130	266	56.0	.....	40.0	.....	4.0 Zn
138.5	281	58.0	.....	42.0	.....	.....
142	288	.....	30.6	51.2	18.2	.....
144	291	60.0	.....	.....	40.0	.....
177	351	.....	.....	67.8	32.2	.....
183	362	.....	38.1	61.9	.....	.....
199	390	.....	.....	91.0	.....	9.0 Zn
221.3	430	.....	.....	96.5	.....	3.5 Ag
236	457	.....	79.7	.....	17.7	2.6 Sb
247	477	.....	87.0	.....	.....	13.0 Sb

FLUXES

While flux is purely an adjunct to soldering and forms no part of the completed joint, it is fully as important as the solder itself. Without the proper flux and its careful use, an unsatisfactory solder join is sure to result.

The functions of a flux are three in number. First, it removes oxide or other surface film from the work after, of course, the parts have been made physically clean. Second, it promotes heat transfer and forms a protective layer over the joint during the soldering operation to exclude air and prevent oxidation before the solder freezes. Third, it reduces the interfacial tension between the solder and the metal being soldered so the solder can rapidly "wet" the surface. In addition to doing these essential things, a flux should be easy to apply and economical to use. It should leave no corrosive residue to attack the joint and give off no fumes which are injurious to the operator.

National Lead Company, as a result of long experience and familiarity with the practical applications of solder, has developed a number of fluxes which are being marketed under the Nalco name. These cover a wide range of uses so that within the following group the average solder user will find a flux to efficiently meet his requirements, whatever they may be.

FLUX No. 1

Soldering Fluid. This is an acid free but corrosive type flux for use on copper, brass, steel, tin and terne plate. It is a general purpose flux for plumbing, refrigerating, air conditioning, metal caskets, auto bodies and work where residue can be removed.

FLUX No. 2

Tinner's Flux. Compounded essentially for galvanized iron work, this is an extremely active liquid flux that will remove the zinc coating beneath the solder and thus prevent brittle joints.

FLUX No. 3

Stainless Steel Flux. This is a liquid flux for use on stainless steel which results in neat, sound joints with a minimum of harmful fumes. It is also very active.

FLUX No. 4

Dipping and Coating Flux. As the name suggests, this strong, acid free fluid flux is especially designed for the hot dip coating of parts in solder. Low water content to minimize spattering.

*Fluxrite Wire Solder may be obtained with this flux.

FLUX No. 5

Sweat Tube Fitting Flux. This liquid flux was developed for soldering sweat copper tube or pipe fittings (sometimes called streamline) where it is essential for the solder to penetrate into the joints by capillary attraction. The flux promotes rapid flow of the solder, including even low-tin and silver-lead solders, and greatly aids the joining operation.

It is also useful for other types of work on copper, brass or steel where rapid action and high penetration are necessary.

FLUX No. 6

Liquid Rosin Flux. A completely non-corrosive rosin flux in a volatile solvent, it provides a reliable, fast acting flux for all general work where the liquid form is more convenient and efficient.

FLUX No. 7*

E 3 A Flux. This flux is a solid rosin base material which leaves a hard, dry residue that is guaranteed non-corrosive. It meets USN Bureau of Ships specification for a non-corrosive flux.

FLUX No. 8*

OPS-1A Flux. This solid flux, of the neutral type, is especially adapted for soldering on brass although it works equally well on copper, tin and terne plate. Should be used with adequate ventilation because of its somewhat unpleasant odor, due to its special composition.

FLUX No. 9

Acid Paste Flux. This is a unique and powerful product which leaves a completely water soluble residue. It can be used on most clean metals except stainless steel and aluminum. Washing quickly removes all residue. This paste can be applied in any position and solder will flow only as far as the flux extends.

FLUX No. 10

Rosin Paste Flux. This is not to be confused with the average non-corrosive paste containing considerable zinc-ammonium chloride. It is a pure rosin product and can be used safely on any type work, no matter how delicate. Like the other Nalco rosin fluxes it will pass the most exacting tests for non-corrosive and electrically non-conductive residue.

FLUX No. 11

Acid Solder Paint Flux. A solder and flux combination, mixed with a special water gel, ready for application. Simply paint it on the work, apply heat and a bright tinned surface results.

Nalco Acid Solder Paint stays in suspension, is always ready to use and will cling to even a vertical surface. It stays on the spot to be soldered. No preheating is required.

It is a great timesaver and convenience in such operations as the backing of electrotypes, tinning bearing shells, auto body work and pretinning parts prior to sweat joining.

*Fluxrite Wire Solder may be obtained with this flux.

FLUX No. 12

Rosin Solder Paint Flux. With this the user has the advantage of both solder and flux. A drop of rosin paint accomplishes two jobs in one operation. Only heat is needed to complete the job. Especially helpful to the electrician, both because of its convenience and its absolute non-corrosive quality. Also useful for small sweating jobs on copper, tin plate and easily soldered metals.

FLUX No. 13

Petrolatum Base Flux. This is a paste flux intended for plumbing, tinning and electrical work. It is especially adapted for use on sweat fittings, copper tubing and gas meter assembling, having a very rapid action and leaving a protective film of petrolatum to prevent corrosion.

FLUX No. 14

No. 14. A radically different type of flux, Nalco No. 14 is as active as a good quality corrosive type yet it leaves a non-corrosive, non-conductive residue. Properly used, in the correct quantity to assure nearly complete decomposition, Nalco No. 14 can be used on practically any job where the non-corrosive properties of a rosin flux were heretofore required. It contains no zinc or ammonium chlorides or free hydrochloric acid.

It is not satisfactory for use on tarnished stainless steel, Inconel and aluminum. It does work on zinc but here it generates a corrosive residue product which must be washed off.

FLUX No. 16

(Similar to No. 14 but in gel form.)

FLUX No. 17

Petrolatum Base Solder Paint. A paste type solder paint suitable for use on all metals except aluminum, magnesium and stainless steel.

Nalco Fluxes Nos. 1, 2, 3, 4, 5, 6, 7, 8, 14 are packaged in pint, quart, gallon, 5-gallon and 55-gallon containers. Nos. 9, 10, 11, 12, 13, 16 and 17 come in ½, 1, 5, and 50 lb. containers.

CAULKING LEAD

For the caulking of joints, particularly in cast iron bell and spigot pipe, lead is the material most frequently used. One of its advantages lies in the fact that it is soft and yielding, thus permitting a certain amount of movement in the pipe without leakage. If a leak does occur, the joint is easily repaired.

For caulking purposes, we furnish lead in two forms—ingot (or pig) lead for cast lead joints and lead wool which is worked cold. Both ingot and wool carry the Lead Industries' Association Seal of Approval—indicating that the lead is of the required purity for caulking purposes.

INGOT LEAD

Ingot lead is cast from selected grades of pig lead in 5-part sectional ingots, solid 5 lb. ingots or 25 lb. and 50 lb. pigs. The sectional ingots are specially designed for caulking purposes. Each section is easily detached from the others and fits the usual melting pot.

Since our ingot lead is made from selected metals, it is easy-flowing and soft which allows it to be readily caulked.

Workman pouring molten caulking lead into a joint in a cast iron water main.

APPROXIMATE QUANTITIES OF INGOT (OR PIG) LEAD AND HEMP REQUIRED FOR C. I. PIPE JOINTS*

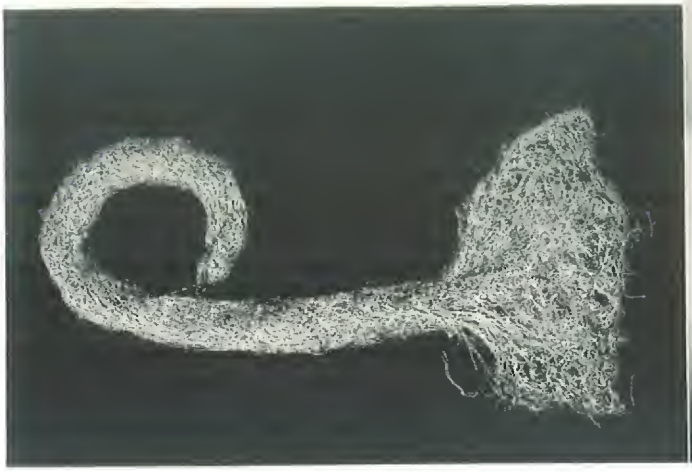
Size of Pipe	Lbs. of Lead per Joint 2 In. Thick		Lbs. of Hemp per Joint	
	Water	Gas	Water	Gas
3	6.00	.....	.18	.....
4	7.50	8.14	.21	.23
6	10.25	11.31	.31	.34
8	13.25	14.56	.44	.49
10	16.00	17.67	.53	.59
12	19.00	20.85	.61	.67
14	22.00	.....	.81	.....
16	30.00	27.20	.94	1.03
18	33.80	.....	1.00	.....
20	37.00	41.28	1.25	1.39
24	44.00	49.07	1.50	1.67
30	54.25	60.06	2.06	2.28
36	64.75	71.57	3.00	3.32
42	75.25	83.13	3.62	4.00
48	85.50	102.63	4.37	5.20
54	97.60	.....	6.25	.....
60	108.30	.....	8.25	.....
72	146.00	.....	12.50	.....
84	170.00	.....	15.00	.....

*From the Cast Iron Handbook (copyright 1927) published by the Cast Iron Pipe Research Association.

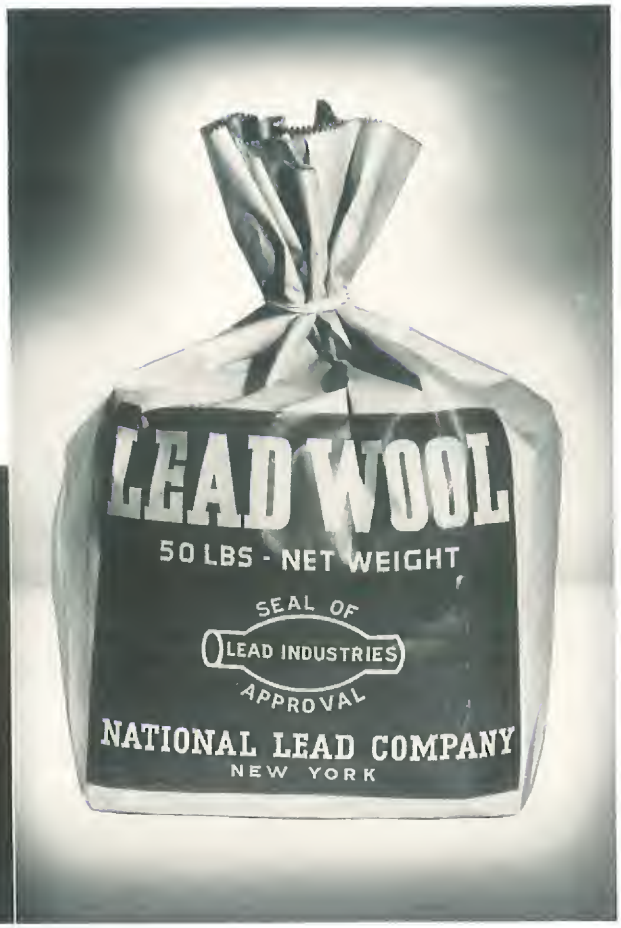
LEAD WOOL

Lead wool is formed from strands of lead twisted loosely into rope form. Many prefer it to ingot lead for caulking purposes because it requires no preheating and thus saves time and labor. Properly packed, lead wool makes a tighter and more flexible joint than a poured joint which tends to shrink slightly after casting. Also lead wool can be used under water, in wet ground or in other places where a cast joint is not practical.

Lead wool comes in 5 and 50 lb. bags or on reels. It runs about 2½ feet to the pound.



Length of Lead Wool. Note fineness and continuity of individual strands



Lead wool is packed in sturdy, waterproof, three-ply kraft paper bags

APPROXIMATE QUANTITIES OF LEAD WOOL AND YARN REQUIRED FOR C. I. PIPE JOINTS

For Pressure up to 500 Lbs.

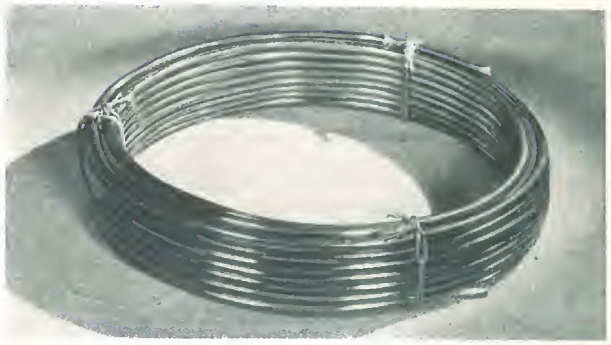
Lead Wool			Yarn	Lead Wool			Yarn
Diam. of Pipe	Depth—Inches	Weight—Lbs.	Depth—Inches	Diam. of Pipe	Depth—Inches	Weight—Lbs.	Depth—Inches
2	1	2	2	14	1¼	16	3
3	1⅛	3	2	15	1¼	18	3
4	1⅛	4.5	2	16	1¼	20	3
5	1⅛	5.5	2½	18	1⅜	22	3
6	1⅛	6.5	2⅝	20	1⅜	25	3⅜
7	1⅛	8.5	2⅝	24	1⅜	36	3⅜
8	1⅛	9	2¾	30	1½	45	3⅜
9	1⅛	11	2⅝	36	1⅝	60	3⅝
10	1⅛	12.5	2⅝	42	1⅝	75	3¾
12	1⅛	14	2⅝				

MISCELLANEOUS LEAD PRODUCTS

LEAD TUBING

Lead tubing is simply lead pipe of an extremely small bore and wall thickness. It is used for the compressed air lines in draught beer installations, gas stove connections, lightning-rod coverings, and in chemical plants. When hardened with antimony, it is employed extensively by player piano manufacturers and organ builders. Its chief advantages are flexibility and permanence.

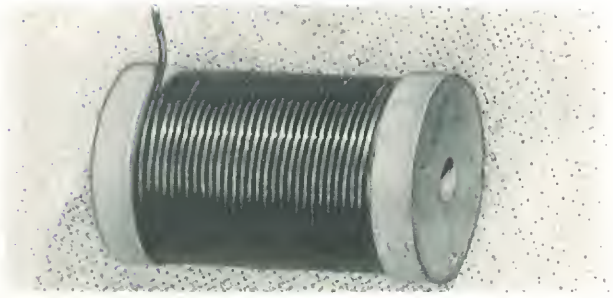
We manufacture lead tubing, either from pure lead or from lead alloyed with tin or antimony.



STOCK SIZES OF LEAD TUBING

Inside Diameter	Outside Diameter	Weight per Foot	Inside Diameter	Outside Diameter	Weight per Foot
1/16"	1/8"	3/4 oz.	1/4"	13/32"	6 oz.
1/8"	13/64"	1 oz.	1/4"	7/16"	8 oz.
1/8"	3/16"	1 1/2 oz.	1/4"	1/2"	12 oz.
1/8"	1/4"	2 oz.	5/16"	3/8"	2 oz.
3/16"	1/4"	2 oz.	3/8"	7/16"	2 oz.
3/16"	5/16"	3 oz.	3/8"	1/2"	7 oz.
1/4"	11/32"	4 oz.	7/16"	1/2"	4 oz.
1/4"	3/8"	5 oz.			

LEAD WIRE



Lead wire is used in a variety of ways. In the smaller sizes, it is employed for bearing alignment work, for caulking, for electrical work and for spray guns in applying metallic coatings. Because of its pliability, non-rusting and non-corrosive qualities, nurseries make use of it for tying up vines and shrubbery. In the larger sizes it is usually referred to as burning bar or rod lead and is used in welding sheet lead. Alloyed with antimony, it is used by battery and brake-lining manufacturers. We sup-

APPROXIMATE NUMBER OF FEET PER POUND OF LEAD WIRE

Gauge No. Birmingham or Stub's	Diameter Mils	Feet per Pound	
		Pure Lead Wire	6% Antimonial Lead Wire
1	300	2.89	3.00
2	284	3.22	3.35
3	259	3.87	4.03
4	238	4.59	4.77
5	220	5.37	5.58
6	203	6.30	6.56
7	180	8.02	8.34
8	165	9.55	9.93
9	148	11.9	12.3
10	134	14.5	15.1
11	120	18.0	18.8
12	109	21.9	22.8
13	95	28.8	29.9
14	83	37.7	39.2
15	72	50.2	52.2
16	65	61.5	63.9
17	58	77.3	80.4
18	49	108	112
19	42	147	153
20	35	213	221
21	32	255	265
22	28	329	342
23	25	417	433
24	22	538	560
25	20	658	685
26	18	813	852
27	16	1020	1056
28	14	1351	1408
29	13	1563	1635
30	12	1852	1913

ply lead wire in practically any gauge desired and of any specified composition. Our product is extruded under high pressure and is guaranteed to be uniform in diameter, true to gauge and free from irregularities or other defects. In addition to round wire, we also supply square, oval, half-round and other shapes on order. Lead or lead alloy wire is ordinarily furnished on reels. However, it will be cut into lengths and boxed, if desired.

TAPE LEAD

Tape or ribbon lead is an extruded product taking the form of long, thin strips of lead. It is used by manufacturers for stamping out products such as washers, dress weights, discs and the like. It is also used for caulking, flashing, patching and, in some instances, for tennis court markers.

Tape or ribbon lead is made up according to specification and is ordinarily furnished on reels. Our stock of dies is large enough to enable us to fill most orders for tape or ribbon lead without the necessity of making up new dies, thus insuring a lower cost and promptness in delivery.

LEAD GASKETS AND WASHERS

We can furnish lead gaskets in any thickness and outside diameter up to 11 feet. These are not a stock article and are made up only on receipt of orders accompanied by blueprints, templates or full specifications as to thickness, inside diameter and outside diameter.

Our stock of dies and punches is such that we can furnish lead washers of practically any size, both in the flat and the concave type.

HARDENING LEAD

Hardening lead is a pure lead, highly refined, for use in the hardening and tempering of steel. Our hardening lead is triple-refined to a purity of at least 99.995% true metallic lead. All lots can be depended upon to be of uniform purity. The lead is furnished in a double pig weighing approximately 50 lbs. The two sections are easily separated.

BAR AND PIG LEAD

We can furnish lead in pig or bar form cast from standard accepted brands of prime metal. The pigs weigh approximately 100 lbs.; the bars are cast or pressed in 5 oz. (approx.) bars and packed in 25-lb. cartons unless otherwise specified. Bars are about ½" thick x 8½" long.

PULVERIZED LEAD

Pulverized or "granulated" lead is used in several industries but chiefly in rubber manufacture. Our pulverized lead is made from standard brands of commercially pure lead. It is available in three sizes—50 mesh, 100 mesh and 200 mesh. Packed in 50 lb. tins; or in 450 lb. kegs.

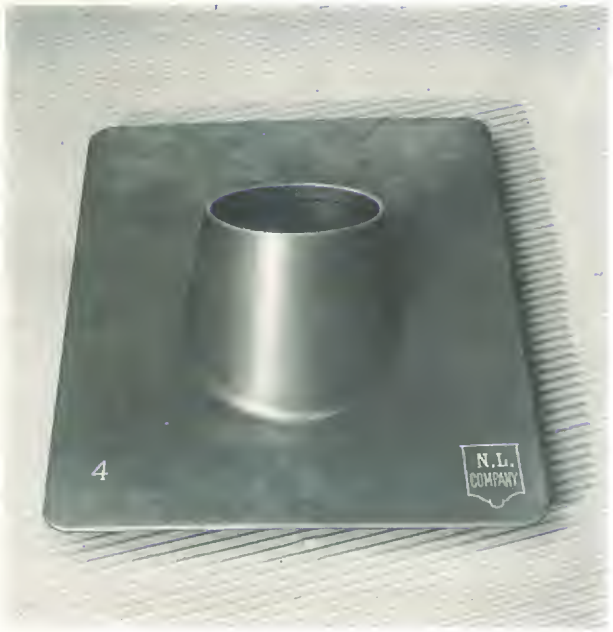
Other pulverized metals also are available.

LEAD SHOT

We manufacture drop and chilled shot in all standard sizes from .04" diameter to .23" diameter. We also manufacture compressed buck shot and lead balls ranging in diameter from .24" to .68". For air rifles, we make a special size of shot known and branded as "Air Rifle Shot." Having a diameter of .175", it is designed for most makes of air rifles. Sold under the brand name "Tatham," our lead shot and lead balls are carefully manufactured to insure roundness, solidity, smooth polish and uniformity and accuracy as to size.

Drop and chilled shot and lead balls normally are packed in 25 lb. bags. Air Rifle Shot is sold in large or small tubes, packed 100 to the case. The large tube contains approximately 4 ozs. of shot; the small tube approximately 2¾ ozs. Air Rifle Shot is also furnished in 1 lb. cartons, packed 25 cartons to the case.

LEAD ROOF FLANGES



Lead roof flanges are preferred by many contractors to flanges made from other materials because they are durable, easy to install and readily adjustable to the roof pitch.

Our flanges are one-piece, high pressure castings of pure lead. They are guaranteed against imperfections common to the average flange such as blow holes, blisters, etc. An exclusive feature is a slightly stiffer apron which guards against possible leakage as a result of wind pressure and consequent curling of the apron away from the roof. These flanges are furnished in eight stock sizes as shown below.

We are also in a position to furnish two-piece flanges made with extra long boots and larger size aprons to conform to government specifications.

PRICES AND SIZES OF STOCK ROOF FLANGES

SIZE	LIST PRICE	WEIGHT OF FLANGE	STOCK PACKAGE	SLEEVE LENGTH	SIZE OF BASE
1¼".....	$1.25	3.00 lbs.	12	2⅝"	7 15/16" x 10½"
1½".....	1.30	3.59 lbs.	12	2¼"	8⅛" x 10 13/16"
2".....	1.50	3.69 lbs.	12	2⅝"	8⅝" x 11⅞"
2½".....	1.60	4.48 lbs.	12	2⅞"	9¼" x 11 15/16"
3".....	1.70	5.00 lbs.	12	2⅞"	9 5/16" x 13¼"
4".....	2.00	6.18 lbs.	12	2⅞"	11 15/16" x 14 5/16"
5".....	3.00	8.50 lbs.	6	4⅛"	13½" x 16½"
6".....	4.30	9.00 lbs.	6	4"	14½" x 17"

LEAD ROOFING WASHERS

We manufacture lead washers in practically any size and of any dimension desired. The stock sizes which we supply for roofing purposes are listed below. These washers are packed according to the customer's order either loose or in 5 lb. cartons, in 50 or 100 lb. boxes. When ordering, state quantity and method of packing desired.

NO.	SIZE HOLE	OUTSIDE DIAMETER	THICKNESS	APPROX. NO. TO POUND
1.....	⅛"	15/32"	.055"	268
2.....	5/32"	15/32"	.055"	263
3.....	5/32"	⅝"	.070"	117
4.....	3/16"	⅝"	.070"	118
*5.....	13/64"	⅝"	.070"	121
**6.....	¼"	⅝"	.070"	125
10.....	5/16"	⅞"	.063"	70

*This size for 3/16" stove bolt. **This size for ¼" stove bolt.

ROOF FLANGE EXTENSION

An all lead extension designed to weatherproof roof stacks or vents flashed with conventional low sleeve flanges or to add reach to existing low flanges. Easily installed for either purpose—no soldering or caulking. Regularly furnished in 7" length in all standard diameters. Special sizes on special order.

DIAMETER IN INCHES	1¼	1½	2	2½	3	4
List Price, each.....	.42	.47	.60	.70	.82	1.07
For each additional inch of length add.....	.06	.07	.09	.10	.11	.15

LEAD SASH WEIGHTS

Because lead combines great weight with small area, it is effectively used for all types of counterbalances. One of the most familiar forms is the lead sash weight. For this purpose, it has the additional advantage of being non-rusting and quieter in operation than weights cast from other metals.

We manufacture both cast and extruded lead sash weights. Any size, any weight and practically any style sash weight can be furnished. Below is a table of the approximate weights per foot of cast and extruded weights in square and round styles.

SQUARE—CAST		ROUND—CAST	
Size	Weight	Diameter	Weight
1″	4¾ lbs.	1″	3¾ lbs.
1¼″	7¾ lbs.	1¼″	6 lbs.
1½″	11 lbs.	1½″	8¾ lbs.
1⅝″	13 lbs.	1⅝″	10 lbs.
1¾″	15 lbs.	1¾″	11¾ lbs.
1⅞″	17¼ lbs.	1⅞″	13½ lbs.
2″	19¾ lbs.	2″	15½ lbs.
2¼″	25 lbs.	2¼″	19½ lbs.
2½″	30¾ lbs.	2½″	24 lbs.
2¾″	37¼ lbs.	2¾″	29¼ lbs.
3″	44¼ lbs.	3″	34¾ lbs.
3¼″	52 lbs.	3¼″	40¾ lbs.
3½″	60½ lbs.	3½″	47½ lbs.
3¾″	69¼ lbs.	3¾″	54½ lbs.
4″	78¾ lbs.	4″	62 lbs.

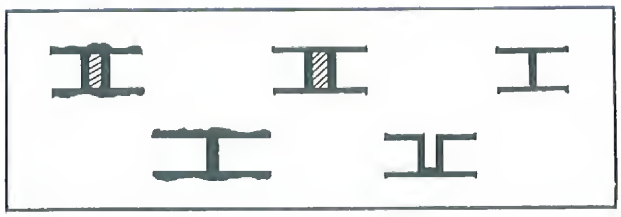
SQUARE—EXTRUDED		ROUND—EXTRUDED	
Size	Weight	Diameter	Weight
1¼″	7.06 lbs.	1¼″	5.50 lbs.
1¼″ x 1½″	10.24 lbs.	1½″	7.82 lbs.
1¾″	14.43 lbs.	1⅝″	9.78 lbs.
1¾″ x 2″	16.35 lbs.	1¾″	11.10 lbs.
2″	18.60 lbs.	1⅞″	12.83 lbs.
2″ x 2¼″	21.60 lbs.	2″	15.30 lbs.
2″ x 2½″	23.60 lbs.	2¼″	19.02 lbs.
2¼″	24.36 lbs.		
2½″	29.48 lbs.		

WEDGE LEAD

Lead wedges are used chiefly for justifying and aligning masonry, especially in such structures as monuments and tombstones. Driven into the irregular spaces left by the stones, they compensate for irregular settling and tend to absorb vibration.

We manufacture wedge lead, both plain and flanged, in all standard shapes and sizes. We will be glad to furnish further information as to other sizes and shapes we produce. Wedge lead is usually supplied wound on reels carrying 50 or 100 lbs. It can also be furnished cut in lengths.

LEAD CAMES



Lead cames or glazier's lead are grooved strips of lead used to support and hold together the panes of glass in leaded glass windows. They are produced by the extrusion process in a wide variety of sizes and patterns.

We manufacture a full line of lead cames in several different styles including round cames, flat cames, colonial cames, High Heart and T cames, and closed slot reinforced cames, a style used in work where the designer wishes to eliminate stay rods. A steel strip running through the central groove of the lead holds the work firmly in place. We also make cames in Antique, Rustic, Rough Cast, Hammered and Frosted designs.

All our cames are made from a grade of lead proved by experience to be the best for the purpose. They are milled so that the cement will take tight hold and prevent leaks. Our came lead is furnished in six foot lengths packed in boxes which weigh approximately 100 lbs., when packed.

STANDARD WEDGE LEAD SIZES

No. 1	3/16″ x 11/16″	Flanged	No. 7	1/4″ x 11/16″	Plain
No. 2	1/8″ x 9/16″	Flanged	No. 8	3/32″ x 7/16″	Plain
No. 3	5/32″ x 7/16″	Plain	No. 9	1/32″ x 1/2″	Plain
No. 4	5/32″ x 11/32″	Plain	No. 10	1/8″ x 1/2″	Plain
No. 5	1/8″ x 5/8″	Plain	No. 11	1/8″ x 3/8″	Plain
No. 6	1/8″ x 11/16″	Plain			

TUBE BLANKS

These blanks of antimonial lead are widely used for collapsible tubes for tooth paste, shaving cream, printing ink, adhesives, painters' and artists' colors and many other commodities.

Available in several types—uncoated antimonial lead, tin-copper alloy, 3% tin-coated, 7½% tin-coated. Other coatings supplied on request. The coating may be specified for the inside of the formed tube, the outside or both inside and outside.

The blanks are made in all standard diameters from .425, which forms a tube 13/32" in diameter, to 2.235", which forms a tube 2¼" in diameter. Blanks for tubes of other dimensions furnished on special order.

Buyers may specify flat blanks, bowl-type or cup-type.

National Lead Company's Tube Blanks are uniform in composition, size, weight and contour. The coating on coated blanks is bonded by a special process to the base metal, insuring a smooth, uniform coating on the formed tube, and a finish that is well adapted to all forms of labeling —stamped, stencilled, printed, lithographed or pasted.

BLANK SIZES FOR TUBES OF VARIOUS DIAMETERS

Diameter of Tube	Approx. Diameter of Blank	Diameter of Tube	Approx. Diameter of Blank	Diameter of Tube	Approx. Diameter of Blank	Diameter of Tube	Approx. Diameter of Blank
2¼"	2.235"	1 3/16"	1.140"	7/8"	.840"	5/8"	.610"
2"	1.960"	1⅛"	1.110"	27/32"	.820"	5/8"	.600"
1½"	1.495"	1⅛"	1.095"	13/16"	.800"	19/32"	.578"
1½"	1.470"	1 1/16"	1.050"	13/16"	.797"	9/16"	.520"
1⅜"	1.350"	1"	.978"	13/16"	.793"	½"	.485"
1 5/16"	1.292"	31/32"	.952"	25/32"	.763"	13/32"	.425"
1¼"	1.235"	15/16"	.925"	¾"	.735"		
1¼"	1.225"	15/16"	.917"	11/16"	.682"		
1 3/16"	1.160"	7/8"	.855"	11/16"	.670"		

LEAD ALLOY COATINGS

Lead alloys which contain 93 per cent or more of lead with small amounts of other metals are being used in increasing quantities for the coating of iron and steel products by the hot dip process.

In addition to their universally recognized high resistance to corrosion, these new lead alloys have a number of other advantages over other coatings applied by the hot dip process. One of these is exceptional ductility. Severe forming and bending operations do not affect the bond between the coating and base metal, since the readiness with which the alloy flows under stress prevents its cracking or peeling. In fact, these coatings facilitate the forming operation by acting as a lubricant.

Another highly desirable feature of a lead alloy coating is its ready acceptance of a paint finish. It is not necessary to weather the surface or to use any special priming procedure.

Also, lead alloy coated iron or steel can be soldered easily with the aid of a mild flux. In many instances, the dipping of small fabricated units completes both the soldering and the coating in one operation. On small parts, such as nuts and bolts, the smooth, even coating has an additional advantage in that it acts as a gasket, making a tighter fit.

The new alloys resist abrasion to a marked degree, due to their inherent hardness which results from careful balance of ingredients.

Lead alloys offer several possible production economies, too. Since, with these alloys, operating temperatures are low, some fuel may be saved. Furthermore, drossing does not occur to any appreciable extent and pot replacement cost is considerably less because there is no alloy attack upon the pot.

One of the first commercial applications of these new lead alloys was in the production of coated sheet steel by the larger steel concerns. Alloys have been applied to both sides of sheets of various gauges, adding from 0.2 ounce to 0.8 ounce per square foot to the weight. Conventional hot dip sheet coating machines are being employed without any major constructional changes in the units.

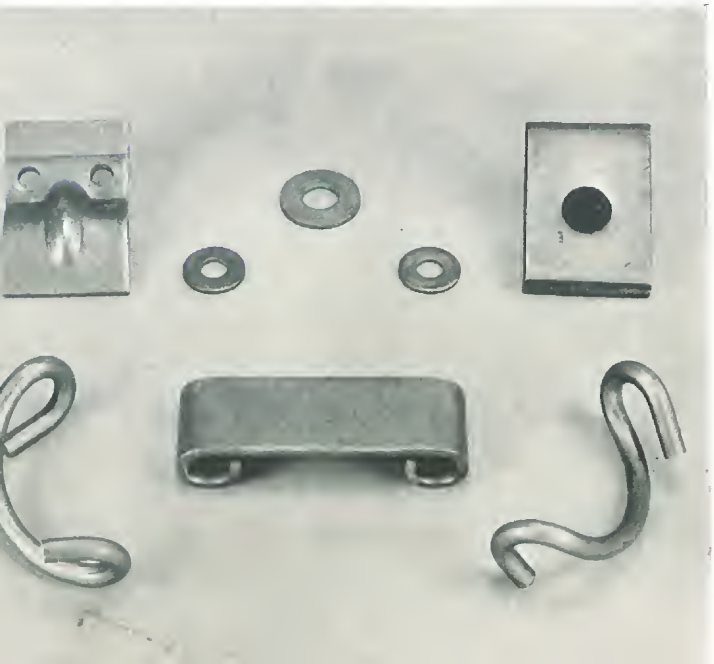
Lead alloys are also being used for the continuous hot dip coating of steel strips. The strips range from one to 26 inches in width and from a few thousandths to several hundredths of an inch in thickness.

Small ferrous and non-ferrous parts in a wide variety of sizes and shapes are being successfully coated by the batch process. In addition, many articles are being dipped after fabrication, notably radiators. Here the lead alloy acts not only as a corrosion preventive coating but also serves to bond the radiator fins to the tubes.

Gasoline tanks, metal containers, farm equipment, fencing, air conditioning ducts and coils, radio parts and housings, meter boxes, drawn auto filters, battery handles, etc., are among the articles now being produced with lead alloy coatings.

Since proper fluxing is of prime importance in the use of these lead alloy coatings, National Lead Company has made available certain fluxes which can be depended upon to do a good job.

For complete information on Lead Alloys write the nearest office of National Lead Company.



BEARING METAL

Bearing metal or babbitt is a general term used to describe a group of alloys of widely varying composition which are used to line machinery bearings. Their function is to reduce friction and save the shaft from injury.

FACTS ABOUT BEARING METAL

There are two varying requirements in a bearing metal. The first is an adequate resistance to pressure so that it may properly sustain the load put upon it in service. The second is the ability to (1) conform to irregularities in the shape or alignment of the shaft and (2) return readily to a smooth surface after being cut or roughened by foreign substances which may get into the bearing. The first requirement is met by a proper degree of hardness and crushing strength. The second is met by a proper degree of malleability.

Other important requirements of a bearing metal are: a low frictional coefficient, a relatively high melting and softening point, and the ability to resist the corrosive action of acids which may form in the lubricating oil at high temperatures.

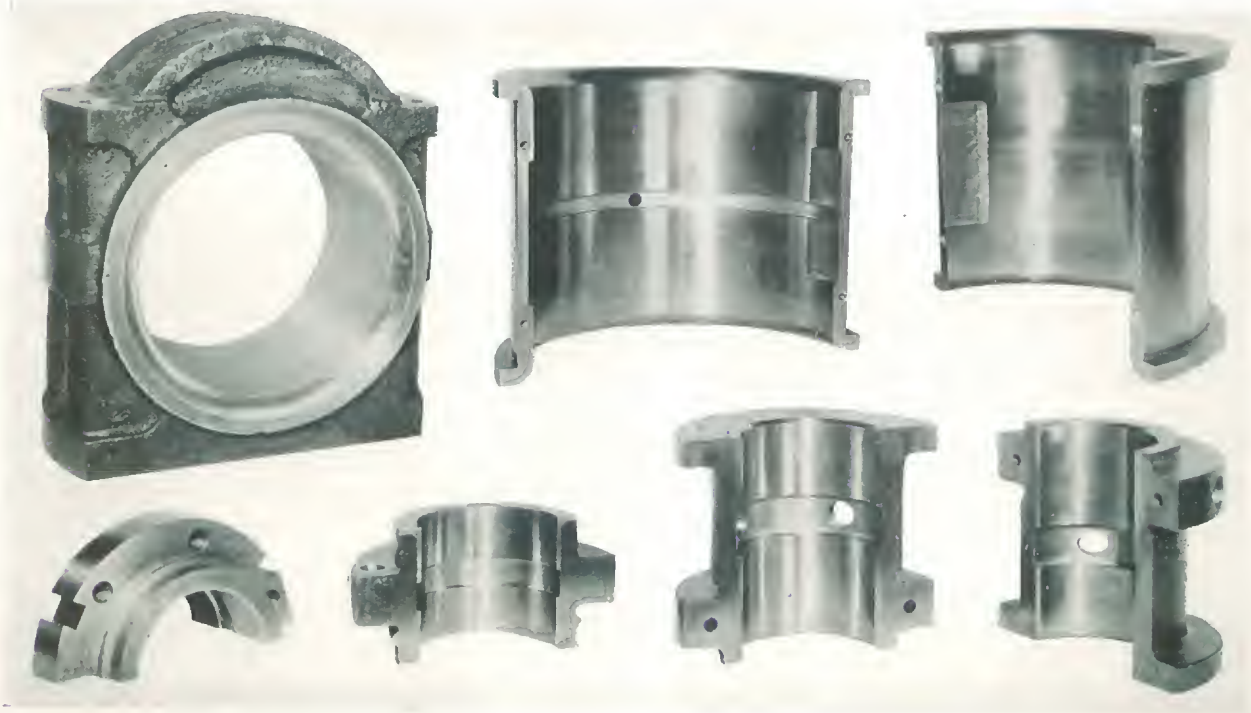
COMPOSITION

The chief constituents of babbitt metal are tin, lead, antimony and copper. The alloys commonly used range from those having a high percentage of tin, with small amounts of copper and antimony and no lead, through intermediate grades containing all four metals to the lower grades which have a high lead content and no tin.

SELECTION OF BEARING METAL

The selection of a babbitt metal depends entirely on the nature of the service it must perform in the bearing.

Where bearings are subjected to heavy loads, high speeds and high temperatures, the use of a better grade "tin-base" babbitt is called for. These alloys are comparatively hard and have a high



Several types of babbitt-lined machinery bearings.

compressive strength, but are tough and not brittle. Furthermore, while tin has a lower melting point than lead, the tin-base alloys are always hardened with a fairly high percentage of copper which means they are never completely fluid until subjected to a temperature 200°-300° above the solidification point. In consequence they retain their hardness better at high frictional heats.

Where bearings are subjected to high speeds but little strain, an intermediate alloy, composed of more nearly equal parts of tin and lead, is satisfactory. These alloys melt at a lower temperature than either the tin-base or the lead-base alloys and, therefore, lose their hardness and strength to a greater degree with rise of temperature and under friction. In this respect, they are not such good bearing metals as the other alloys, although they find use in very thin linings where their superior fluidity combined with their property of adhering firmly to a tinned bronze or steel backing is of advantage and where lack of strength is not objectionable.

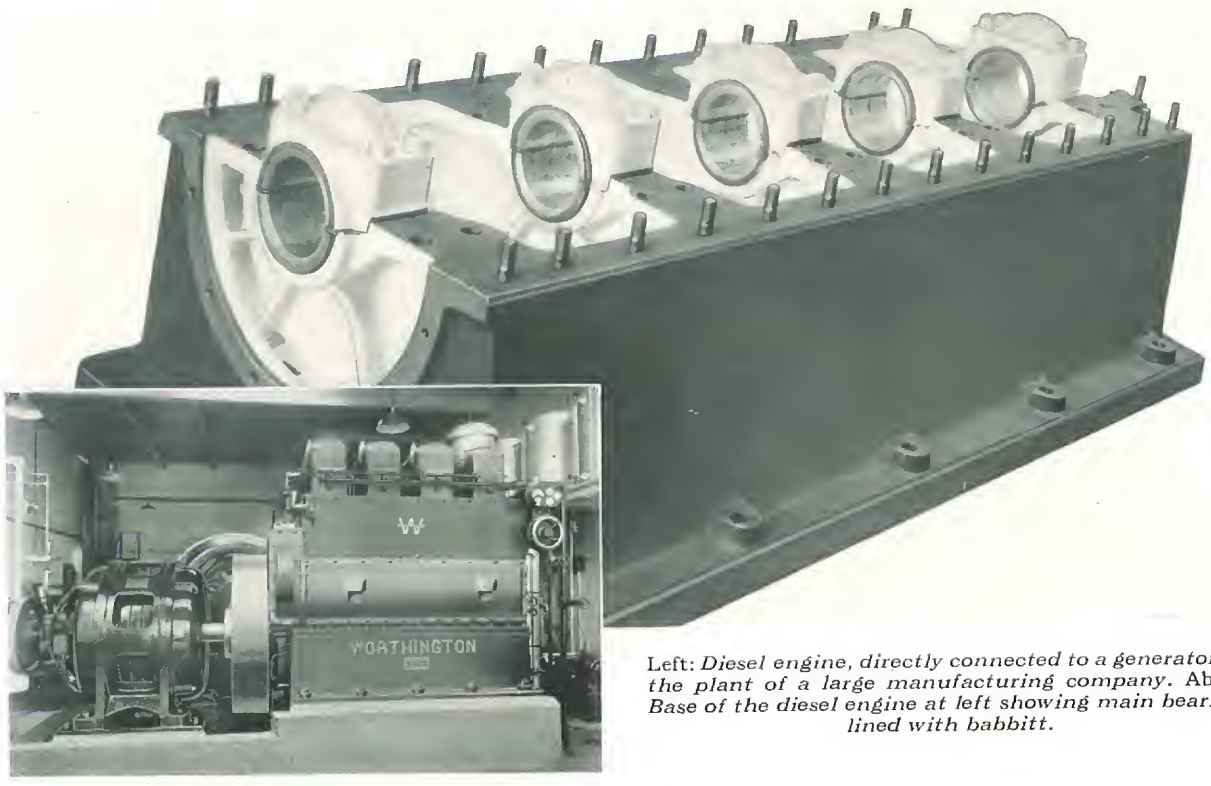
For bearings operating at low speed and carrying little weight, a lead-base alloy will suffice.

OUR LINE OF BEARING METAL

Under the Dutch Boy and Hoyt Metal Co. trademarks, we manufacture a complete line of bearing metals designed to fill most bearing requirements. The approximate physical properties of these alloys as well as a general indication of the types of bearings in which they are commonly used will be found on the following pages.

In addition to our branded metals, we are equipped to furnish special alloys in accordance with customers' formulas. We also make analyses of samples and furnish bearing metals which duplicate these analyses.

Our bearing metals are ordinarily furnished in an easily handled ingot form. However, we can supply babbitt in any shape desired, either cast or extruded in wire form for use in spray guns.



Left: *Diesel engine, directly connected to a generator, in the plant of a large manufacturing company.* Above: *Base of the diesel engine at left showing main bearings lined with babbitt.*

DUTCH BOY* BEARING METAL

The bearing metals sold under the Dutch Boy trademark cover a wide range of uses and needs. They are carefully and expertly alloyed from pure, clean metals. All the grades are cast in round-bottom molds. The ingots fit an ordinary ladle.

DUTCH BOY PHOENIX METAL*

This bearing metal is the top grade in our Dutch Boy line. It is recommended for heavy work and high speed machinery.

When melted, Phoenix Metal is very fluid and can readily be run into the smallest boxes. It is tough, hard and elastic. Where great ductility is required—for example, in cases where the hammering action caused by the play of the shaft may bring about fracture in the lining material—Dutch Boy Phoenix is distinctly superior. Phoenix Metal is especially adapted for crank pins, cross-heads, main bearing and pillow-blocks of large shafts, in automobiles, dynamos, marine engines, gang saws, rock crushers, etc.

* Trade Mark Reg. U. S. Pat. Off.

DUTCH BOY HEAVY PRESSURE METAL

This alloy, like Dutch Boy Phoenix, is designed for the highest grade work and, like Phoenix, contains no lead. Its special characteristic is great resistance to crushing strain. It will stand the most severe pounding without squeezing out. It is harder than Phoenix, and for that reason is to be preferred for some purposes.

Because it contains no lead and has a high percentage of copper, Dutch Boy Heavy Pressure Metal melts at a high temperature, is easily chilled, and retains its hardness at the highest temperatures at which bearings operate.

In melting, Heavy Pressure requires more heat than Phoenix to bring it to a perfectly fluid condition. Consequently, it cannot be so readily poured into a very thin bearing. Heavy Pressure is preferred to Phoenix where the design of bearings is such that an excessive pressure per square inch of bearing surface is developed. In such cases it fre-

Babbitt-lined machinery bearings grouped around a jig and mold set-up for casting linings.

quently pays to sacrifice the greater fluidity and malleability of Phoenix for the sake of the extra resistance to unusually severe pressure.

DUTCH BOY GENUINE BABBITT METAL

Dutch Boy Genuine Babbitt Metal is made exactly according to Isaac Babbitt's formula patented in 1839. It analyzes as follows: tin 88.9 per cent, antimony 7.4 per cent, copper 3.7 per cent. The Dutch Boy trademark on this alloy constitutes a definite guarantee that its composition is as stated. This is important because the term "genuine babbitt" has been applied at times to alloys which vary more or less widely from the original formula.

DUTCH BOY NO. 1 JOURNAL METAL*

This metal is compounded expressly for large bearings where the pressure, though heavy, is steady—on heavy engine and general mill work, for instance.

While Dutch Boy No. 1 Journal will stand practically as much crushing strain as Dutch Boy Phoenix or Dutch Boy Heavy Pressure, its melting point is much lower and it will not do the work of Phoenix or Heavy Pressure when subjected to excessive speed. However, it retains a high degree of hardness at 212°F, a temperature often reached by bearings in operation, being exceeded in this respect only by Heavy Pressure.

Dutch Boy No. 1 Journal is easily poured, with very little shrinkage. It is good for use in steam winches and other hoisting machinery.

DUTCH BOY STERLING JOURNAL METAL*

This is a copper-hardened metal, high in tin, capable of resisting considerable crushing strain. It is the grade used largely in stationary gas engines and for other equipment in many fields where a lower-priced metal than Dutch Boy Phoenix is desired, and yet one that will do satisfactory work, except under the most severe service. Its desirable qualities are fluidity superior to the tin-base alloys containing more copper, and the property of adhering better than the alloys containing more lead.

DUTCH BOY PERFECTION ANTI-FRICTION METAL

Perfection Anti-Friction Metal is a copper-hardened alloy which sells at a popular price. It has an unusual resistance to crushing strain for this

*Trade Mark Reg. U.S. Pat. Off.

grade of metal, and its hardness at 212°F is ample for normal requirements.

Due to its low melting and liquefaction points, Perfection Anti-Friction will be found to be an easy handling metal, flowing freely at less than 500°F. It peens easily and oil clings tightly to its surface.

Except where the most excessive strains and the highest speeds are developed, this alloy is recommended for all types of machinery.

DUTCH BOY BEARING METAL

This metal is used satisfactorily on many kinds of machinery and general mill work. It is the exact equivalent of many anti-friction metals sold at double its price. Dutch Boy Bearing Metal is adapted for pulleys, hangers, line shafting and slow-moving machinery.

Pouring a babbitt lining. This method, used in many machine shops, is usually employed for the smaller bearings.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF DUTCH BOY BEARING METALS

Grade	Phoenix	Heavy Pressure	Genuine Babbitt	No. 1 Journal	Sterling Journal	Perfection Anti-friction	Bearing Metal
Specific Gravity	7.478	7.526	7.477	7.637	8.810	9.878	10.116
Wgt. Lbs. Per Cu. In.	.270	.272	.269	.276	.318	.357	.365
Solidus—°Cent.	234	238	238	185	184	244	239
—°Fahr.	453	460	460	365	363	471	462
Liquidus—°Cent.	371	407	362	291	346	257	260
—°Fahr.	700	765	684	556	655	495	500
Proper Pouring Temp. (°F.)	825	890	809	681	780	620	625
Tensile Tests							
Ult. Str. Lbs./Sq. In.	9,460	12,280	10,910	12,760	9,325	11,557	9,100
Elongation %	16.8	6.3	14.9	3.3	1.4	2.6	3.8
Compressive Strength (App. Deformation of Cyl's. 1" Dia. x 2" High at 70 °F.)							
At 1,000 Lbs./Sq. In.	.0001"	.0000"	.0000"	.0005"	.0002"	.0001"	.0001"
At 5,000 Lbs./Sq. In.	.0017"	.0004"	.0015"	.0023"	.0014"	.0043"	.0040"
At 10,000 Lbs./Sq. In.	.0800"	.0080"	.0120"	.0180"	.0306"	.0311"	.0300"
Brinell Hardness							
At 20°C.— 68°F.	24.0	32.3	26.7	32.4	23.3	27.5	23.5
50°C.—122°F.	18.1	24.7	20.8	20.8	14.1	19.9	17.3
100°C.—212°F.	12.2	16.0	12.2	15.0	10.9	13.6	11.9
150°C.—302°F.	8.1	11.3	8.1	10.0	6.4	11.3	7.5
200°C.—392°F.	4.5	5.9	4.9			3.4	3.4
Brinell No. at 20° C. after annealing 28 days at 100° C.	23.1	31.5	25.4	28.4	20.0	23.0	19.1

HOYT BRAND BEARING METALS

Babbitt metals carrying the name "Hoyt Metal Co." have been known and used in the trade for more than a half century. Carefully made from pure, clean metals, these alloys are recognized as standard, high grade babbitts everywhere. Several of the more popular brands are described on this and the following page.

GENUINE-A* BABBITT METAL

Hoyt's Genuine-A has been the standard for many years in all types of machinery where a high grade babbitt is necessary. It is being successfully used in babbitting the bearings of electrical machinery, locomotive cranes, steam shovels, concrete mixers and other machinery where a heavy load is distributed over a comparatively small bearing surface or where excessively high speeds are developed.

* Trade Mark Reg. U. S. Pat. Off.

DIESEL OIL ENGINE BABBITT

This grade of babbitt is especially alloyed with a view to withstanding the extreme pressure caused by impact in the largest of the diesel type engines. Due to its extreme toughness and low coefficient of friction, it is a reliable babbitt for use in marine or industrial installations of internal combustion engines. It is also well suited to give dependable service under the high speed and the heavy pressures encountered in aircraft and automotive motors. It may be used in the form of a poured or die cast bearing or the lining of a bronze shell.

TROJAN BABBITT METAL

Trojan Babbitt has been used successfully as a substitute for genuine babbitt in steam engines, motors, internal combustion engines or other types of equipment where the service required is not excessive.

It is also used extensively in hoisting engines, dredging machinery, tractors and harvesting machinery.

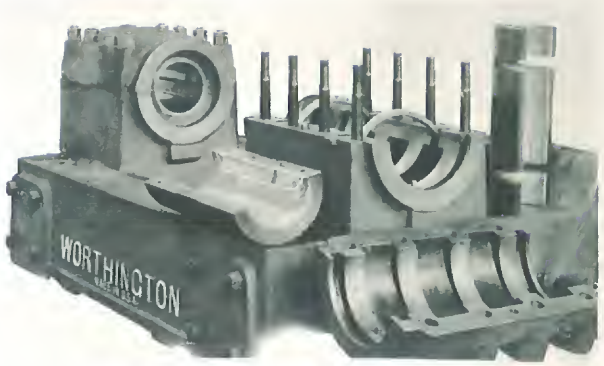
FAULTLESS-A BABBITT

This bearing metal is a scientifically alloyed mixture of lead, tin, antimony and copper. It is designed for use in sawmill and other woodworking machinery subject to sudden and intermittent strain.

The extreme fluidity of Faultless-A Babbitt insures better adherence to either a bronze or steel backing than is possible with the ordinary lead-base babbitt. This is true when even very thin linings are being cast.

EAGLE-A BABBITT

Eagle-A Babbitt is a popular priced lead-base bearing metal suitable for many types of general service. It has been used with complete satisfaction in machine shops, cotton gins, harvesting and woodworking machinery, under comparatively



Above: *Ring oiling pinion shaft bearings on a horizontal power pump (housing in foreground removed to show rings.)*

heavy loads and high speed. On the basis of its performance, this alloy can safely be called superior to many other brands which sell for a higher price.

HOYT'S STANDARD NO. 4

This grade is a standard utility babbitt made from selected metals and suitable for line shaft and other installations where the load is not excessive and the bearing is not subjected to sudden strain.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF HOYT BRAND BEARING METALS

Grade	Genuine-A Babbitt	Diesel Oil Engine	Trojan Babbitt	Faultless-A Babbitt	Eagle-A Babbitt	Standard No. 4
Specific Gravity	7.34	7.46	7.75	9.005	10.04	10.67
Wgt. Ozs. Per Cu. In.	4.24	4.31	4.48	5.2	5.8	6.17
Solidus—°Cent.	225	238.8	187	184.4	243	247
—°Fahr	437	462	368.6	364	469.4	476.8
Liquidus—°Cent.	371	422	282	292.2	260	265
—°Fahr	699.8	791.6	539.6	558	500	509
Proper Pouring Temp. (°F.)	824	916	700	683	625	634
Compressive Strength (App. Deformation of Cylinders, 1¼" Dia. x 2½" High at 70°F.)						
At 1,000 Lbs./Per Sq. In.	.0000	.0000	.0005	.0012	.0020	.0025
5,000 Lbs./Per Sq. In.	.001	.0005	.0023	.0040	.0090	.0170
10,000 Lbs./Per Sq. In.	.015	.013	.0104	.0140	.0620	.2850
Brinell Hardness						
At 21° C.— 70°F.	28.6	34.4	27.4	21.8	23.5	14.3
100° C.—212°F.	12.8	15.7	11.2	8.2	11.9	6.4

HOYT NUMBER ELEVEN METAL

Hoyt Number Eleven Metal is a high-grade babbitt, specially designed for use in equipment where the service is exceptionally severe—for example, in aircraft engines, where fairly heavy loads must be sustained for long periods at high speeds.

Hoyt Number Eleven Metal has high anti-frictional qualities and exceptional toughness. It retains its hardness and resistance to crushing strain to a considerable degree even at elevated temperatures.

This alloy is being successfully used, not only in aircraft engines, but in marine engines, steam turbines, and other large equipment where bearings are subjected to high speeds and either constant or intermittent loads.

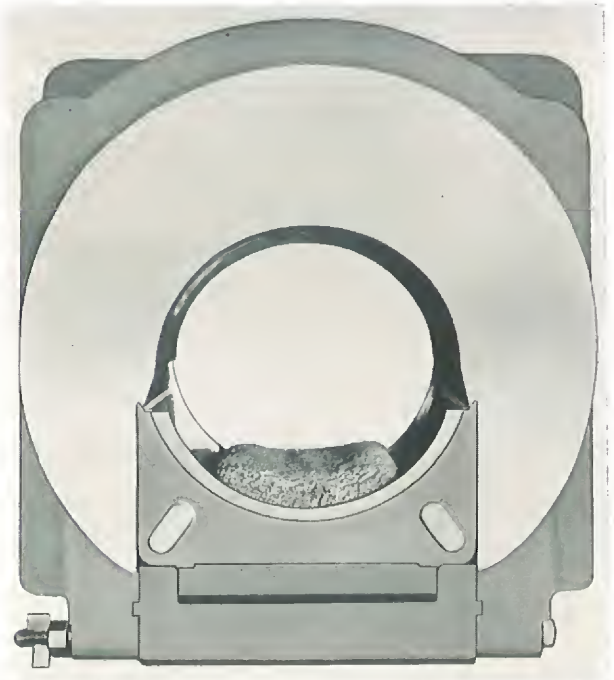
SATCO*LINED BEARINGS

National Lead Company, through its subsidiaries, the Magnus Metal Corporation and the American Bearing Corporation, manufactures and sells bearings lined with Satco Metal for use in diesel engines, steam and electric locomotives and cars, and for various types of machinery.

The lining metal used in these bearings is a patented alloy developed especially to meet modern service conditions where bearings are subjected to unusually high speeds and heavy loads. It is being used successfully in railway work as a lining for truck and trailer brasses, car journal bearings, cross-head gibs, lateral hub facings, etc. It has also proved superior to standard composition alloys in internal combustion engines and for various other types of machinery.

Satco Bearing Metal combines the hardness of the most costly white metal alloys with the advantage of an initial melting point 100° F. higher. It has a solidification temperature of 563° F. and a complete liquefaction temperature of 788° F. This quality is important as it greatly increases the resistance of the lining to failures due to a breakdown of lubrication in service.

Another outstanding characteristic of Satco Bearing Metal is its high resistance to transverse stresses, a quality which minimizes the tendency of the lining to crack or deform under heavy loads.



Satco-lined lateral hub facing for engine-truck, trailer and driving boxes.

* Trade Mark Reg. U. S. Pat. Off.

DATA ON SATCO BEARING METAL

	Satco	Tin-Base Babbitt	A. A. R. Lining Metal
Brinell Hardness			
At 70° F.	23.8	22.2	17.8
150° F.	19.7	17.2	13.2
212° F.	17.2	12.9	9.5
300° F.	12.0	7.6	4.2
350° F.	9.6	3.5	†
400° F.	7.7	†	†
Ult. Compressive Str. Lbs./Sq. In.			
At 70° F.	16,300	17,200	15,600
150° F.	12,300	11,200	9,500
212° F.	10,200	7,500	6,100
300° F.	7,000	4,000	2,700
400° F.	3,700	2,000	1,200

†Metal too soft to determine hardness.

TYPE METALS

Type metals—the group of lead-base alloys used by job printers, publishers and trade compositors for casting type, slugs and electrotypes—are unique among metal products in one respect. Constantly being melted and reused, they require intelligent serviceing. The working stock must be "toned up" with new metal from time to time. Periodic analyses of composition are necessary.

For this reason, the experienced buyer of type metal usually prefers to buy from a concern which not only furnishes high grade metal but is able and willing to help him care for the metal properly.

National Lead Company has been supplying Blatchford type metal to printers for a good many years. Its sales and technical staffs are thoroughly familiar with printing equipment and the proper

The good casting quality of our linotype metal insures sharp, clean type.

National Lead Company's Blatchford Type Metals are cast to fit all types of feeder mold equipment, automatic as well as hand fed.

care of type metal. They are ready and willing at all times to render advice and assistance in the solution of metal problems.

Furthermore, a complete type metal service plan is available. When desired, customers' metal stocks are carefully analyzed at regular intervals, dross exchanged and the correct toning metal sent to maintain an efficient, properly proportioned working supply.

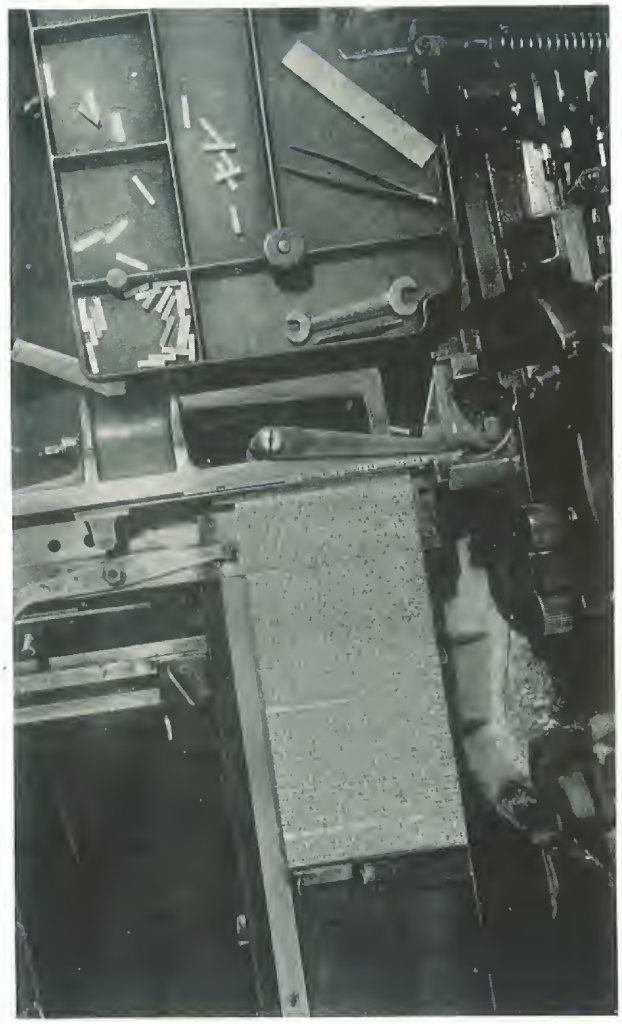
As described on this and the following pages, National Lead Company manufactures a complete line of type metal designed to fill every type or plate casting requirement. Each alloy is made from pure, clean metals to insure that it will be free-flowing, have good casting qualities and a low rate of drossing. Moreover, National Lead Company's type metals can be depended upon to be always uniform in quality and composition.

LINOTYPE METAL

Linotype metal contains lead, tin and antimony. The tin contributes toughness, and the antimony contributes hardness. Good linotype metal must be made from absolutely clean metals. It should be free-flowing and have desirable surface tension. The presence of all these qualities insures the casting of sharp, clean type.

While linotype metal is used principally on Linotype, Intertype and Ludlow machines which cast a single slug, it is also used on Monotype Strip Material and Elrod machines, casting either rule borders or spacing material. In some newspaper plants, it is also used for the casting of flat printing plates from mats.

Linotype metal is carried in stock in three-sectional ingot bars and is packed in 250-lb. cases. It is also available in bars, suitable for use in automatic feeders.



Above: *Casting unit of the monotype typesetting machine delivering type.* Below: *Casting and cutting stereotypes. The metal is heated in the immersion gas-fired pot in the background.*

MONOTYPE METAL

Monotype metal is alloyed from the same metals as linotype metal although it contains a larger percentage of tin which increases its strength, and a larger percentage of antimony which makes it harder. This alloy is used principally on monotype machines which cast single letters or characters.

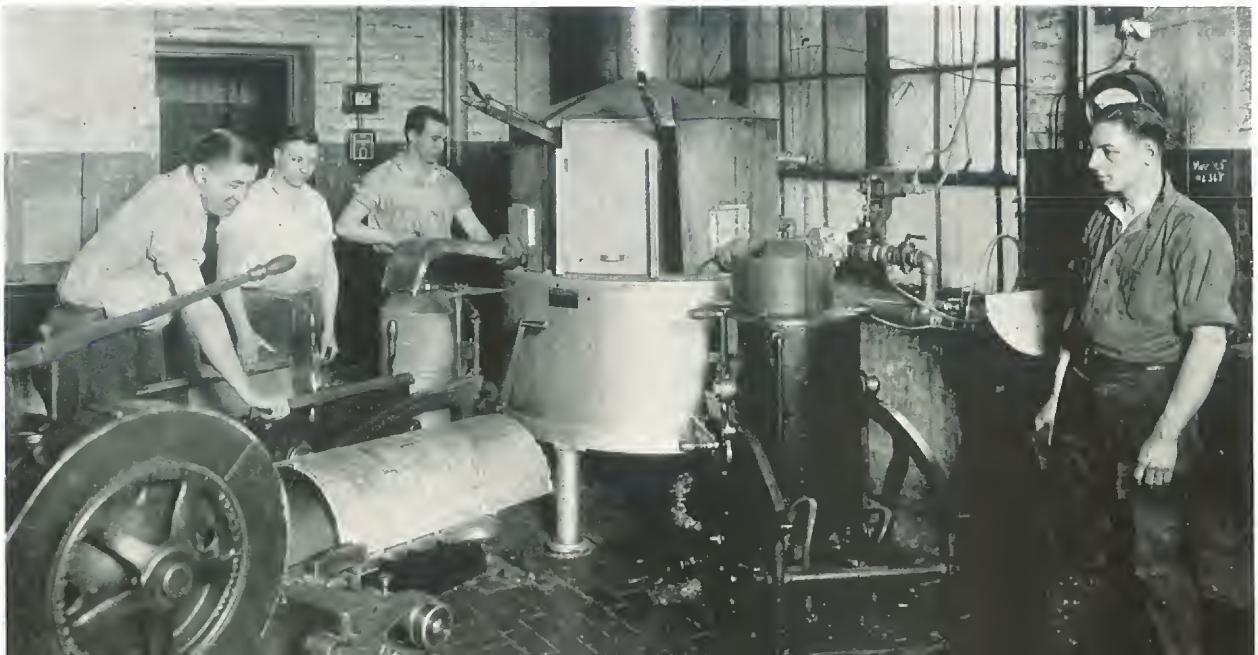
However, our monotype metal is sufficiently hard to be used, not only on monotype machines, but also on the Monotype Sorts Caster for casting hard type, usually in the larger sizes, for hand assembly.

Monotype metal is furnished in ingot form. The ingots weigh approximately 1¼ lbs. each and are packed in 250-lb. cases.

STEREOTYPE METAL

Stereotype metal is alloyed from the same metals as linotype and monotype metal. Ordinarily its hardness is about midway between the two.

The principal uses for stereotype metal are in casting the curved plates used in newspaper printing and in casting flat plates from the mats supplied to newspapers. However, many printers are now buying stereotype equipment for the casting of plates in general work. Stereotyping is a simple process and, where repeat orders are contemplated—book work, form printing, catalogs—the stereotype matrix is kept in stock, avoiding the



necessity of tying up expensive foundry type awaiting further orders.

Stereotype metal comes cast in pigs of 50 to 65 lbs. each. Smaller ingots furnished if desired.

SORTS CASTER METAL

Sorts Caster metal is a hard monotype metal which contains, in addition to tin and antimony, a small percentage of copper. It is widely used in Monotype and Thompson Type Casters. The type cast is in every way comparable to foundry type.

Sorts Caster metal comes cast in ingot form and packed in 250-lb. cases.

COMBINATION METAL

Combination metal is a special alloy midway between linotype metal and stereotype metal. It is designed particularly for use in shops where it is not considered desirable or feasible to maintain two remelting pots—one for Linotype and the other for Stereotype.

Combination metal is furnished in ingot form.

Our Sorts Caster metal produces type comparable in all respects to foundry type.

ELECTROTYPE METAL

Electrotype metal is a "backing" metal and is used to give body to a copper or nickel-faced electrotype. While it is alloyed from the same ingredients as the type metals, the tin and antimony are present only in small quantities.

In commercial electrotype plants, the metal, of course, is not reused. In publishing houses and among large job printers, however, the backing metal is frequently melted from the nickel or copper shell and used over again. Concerns following this practice should have their working stock analyzed before ordering new metal. Electrotype metal becomes rich in tin after successive remeltings, due to the tin foil used in backing.

Electrotype metal is furnished in pig form.

BLATCHFORD METAL FLUX

For reducing dross and cleaning all type metals. Sold in 5 lb., 25 lb. and 50 lb. containers.

NOTE: Nalco Solder Paint is a real time saver and a great convenience in electrotype backing. Composed of finely divided solder and flux particles held in suspension in a special water gel, Nalco Solder Paint is applied to the back of the electro in the same way as a regular paint.

Molding press for use in molding impression lead.

IMPRESSION LEAD

In many electrotyping foundries, impression lead, rather than wax, is used as the molding material for the reproduction of very fine halftones and the plates used in multi-color printing. The use of impression lead obviates imperfections and distortions which frequently occur in wax molding because of dimensional changes in the wax.

National Lead Company manufactures three grades of impression lead: plain impression lead; ready-to-mold impression lead; and tin-coated impression lead.

Plain impression lead is simply a pure grade of lead in sheet form of uniform thickness and softness. Ready-to-mold impression lead is a lead sheet which has been scratch-brushed after rolling and sprinkled with graphite. The protective coating of graphite prepares the surface for the electroplating bath and retards corrosion. Tin-coated impression lead is so made to prevent corrosion.

Impression lead sheets are furnished in any size according to specification. Maximum size sheets measure 24″ x 36″.

ELECTROTYPE CASES

Electrotype cases are lead alloy sheets used by electrotypers for wax molding. They can be supplied ⅛″ thick (or heavier, if desired) and in any width and length specified. One side of the sheet has been wire-brushed to insure close adhesion of the wax. The maximum size for electrotype cases is 22½″ x 33½″.

MUSIC PLATES

Music plates are made of an alloy of lead and used by printers of sheet music. The engraver first rules the plates with a special five-pronged fork and then stamps on the notes with steel dies. A proof is taken and printing plates are made from the proof.

We manufacture music plates in various compositions of tin, lead, antimony and copper. The plates are uniform in thickness and rolled to a high luster. They are rectangular in shape and usually measure 6½″ x 9½″, 8″ x 11″, or 9½″ x 13″. Larger or smaller sizes can also be furnished.

TINT PLATES

Tint plates are used for color work by many large printing houses. They are also used for printing names, trademarks and designs on fabrics by bag companies, cotton mills, etc.

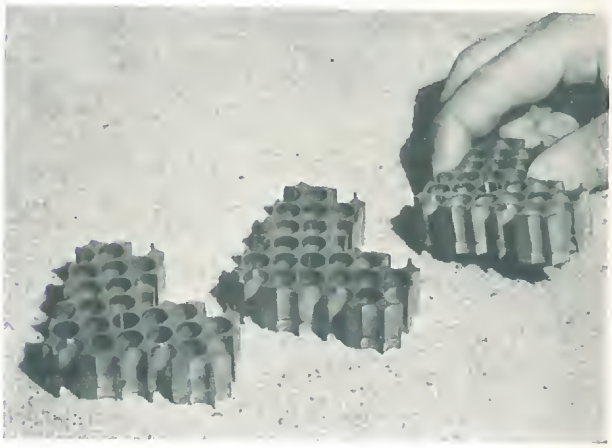
Tint plates are cast from varying proportions of lead, tin and antimony. They are planed on a planer and shaved on one side to a high luster with a shaving knife. Our tint plates are very accurate in measurement. Minimum thickness supplied is .155″; maximum size 22½″ x 33½″. Smaller sizes are furnished on request.

BLATCHFORD PLATE MOUNTING SYSTEM

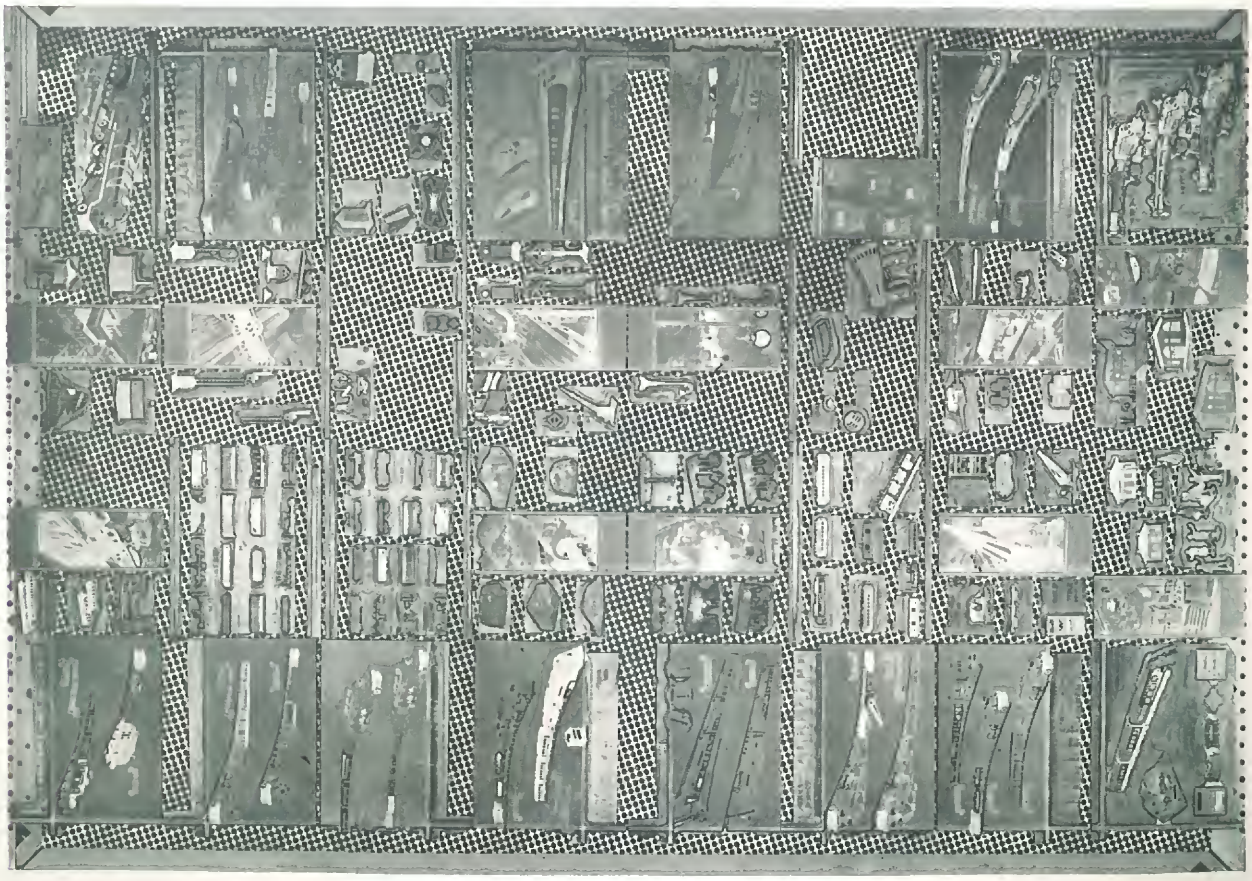
The Blatchford System for mounting printing plates has been scientifically designed and then perfected by printers themselves to meet the requirements of all classes of printing production.

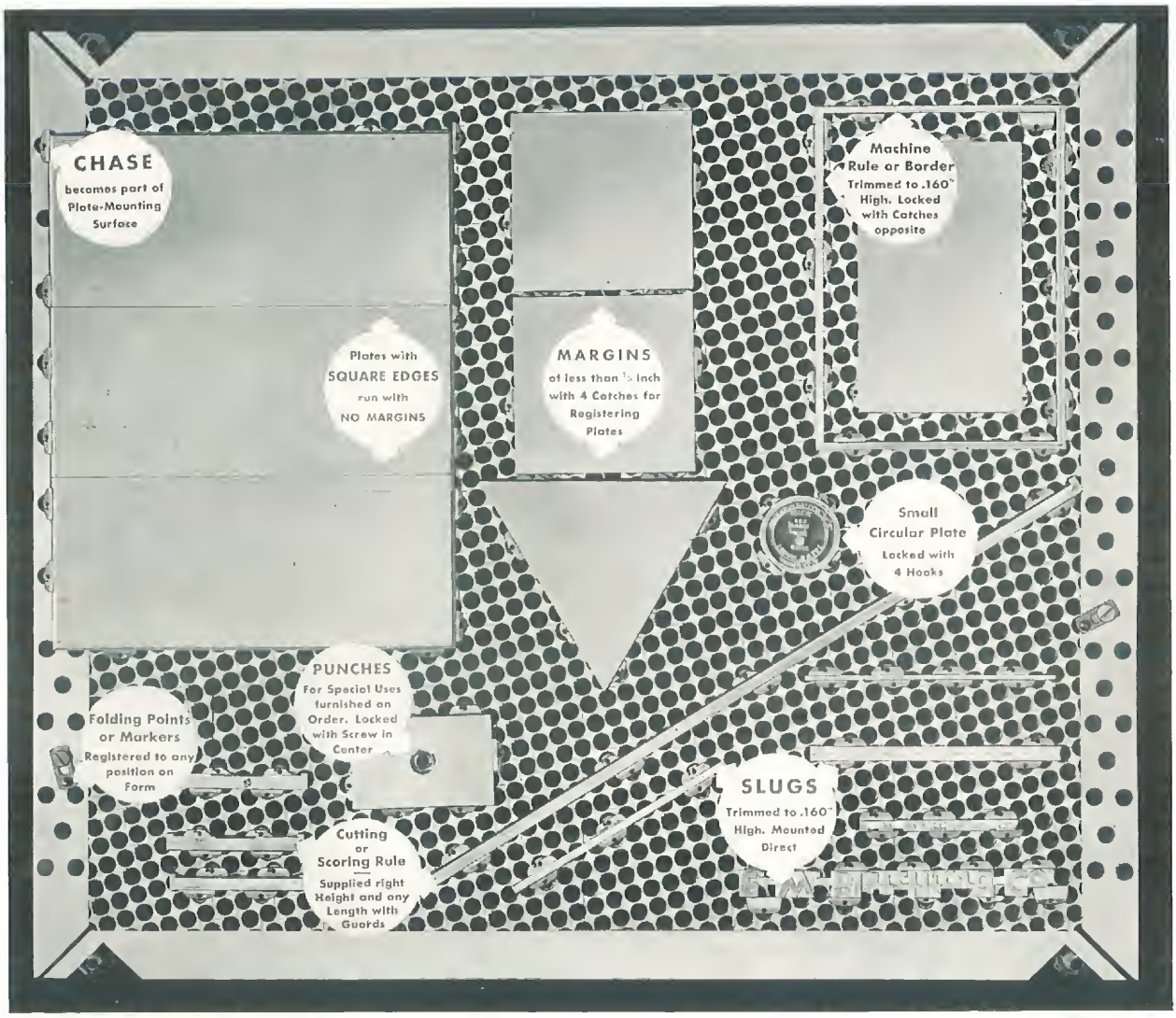
Its advantages are many. It is simple in construction. It provides a uniform support for every square inch of printing surface of every printing plate. Hair line register is obtained with a minimum ot time and effort. Plates cannot move on the base auring the longest runs once they are properly positioned and locked. By virtue of the unusual shape of the sectional unit, a "straight line of break" is eliminated.

The basic unit of the Blatchford System is a "honey-combed," six-sided, L-shaped section, the working surface of which is ruled in quarter-inch squares, providing a fractional-inch, rather than a pica, gauge for the make-up man.



Above: *"L" shaped units of the Blatchford base.*
Below: *A fine example of intricate plate mounting by the Steidinger Press of New York City. It is the "red" form of a four-color process job printing on a 46¼" x 70" sheet. There are 121 separate plates in this form. It would have been impossible to mount these plates on any other base with sufficient catches to properly hold and register them.*





The numerous advantages of the Blatchford system of plate mounting are demonstrated in a most practical manner in this illustration. Besides the usual printing plates, all accessory devices—punches, cutting, perforating and scoring rules, folding points or markers, machine rules, borders, etc.—are accommodated on Blatchford Base. Many of the time and labor saving short cuts indicated in the above lock-up are possible only with Blatchford Base.

The odd shape of the unit gives the Blatchford System an exclusive advantage: when woven into a form or bed, each unit has six similar units holding it in place—instead of four as with square-shaped sections. By thus eliminating a "straight line of break", there is less possibility of springing or warping a form in lock-up.

Furthermore, there are no restrictions in handling small plates in the Blatchford System. Plates as small as $1\frac{3}{4}$" x $1\frac{1}{4}$" or $\frac{5}{8}$" x 2" can be registered and locked each with six hooks and with margins of $\frac{1}{8}$". A plate as narrow as a 6-point linotype slug can be mounted and supported with a pair of catches opposite each other at $1\frac{1}{4}$" intervals.

INQUIRIES

Further information about the Blatchford Plate Mounting System will gladly be furnished on request. Address your inquiry to National Lead Company, E. W. Blatchford Co. Branch, 63 Park Row, New York City, or 900 W. 18th St., Chicago.

GRID METAL

Grid metal is lead hardened with antimony. It is used by battery manufacturers for casting the frames or perforated plates which hold the lead oxides in a storage battery.

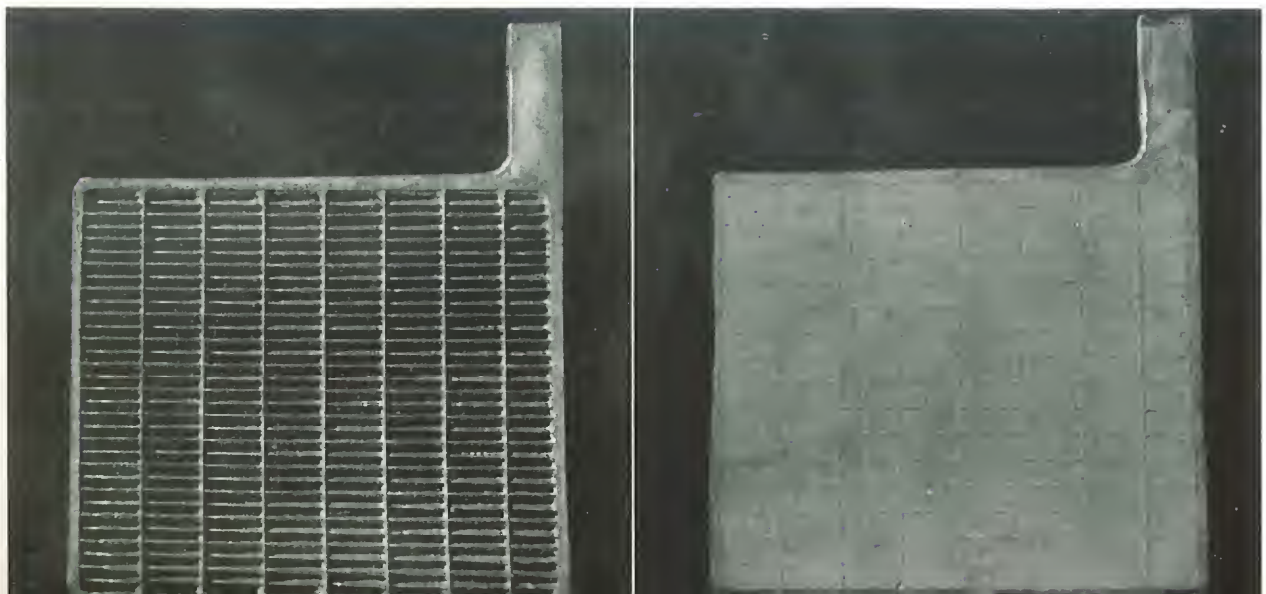
We manufacture grid metal of a uniformly high quality. The purity of the metals used as well as the exactness with which the alloy meets our customer's specification as to antimony content and tolerance of impurities is a primary consideration with our production department. Our grid metal is usually furnished in 60 lb. pigs although lighter weight pigs may be obtained if desired.

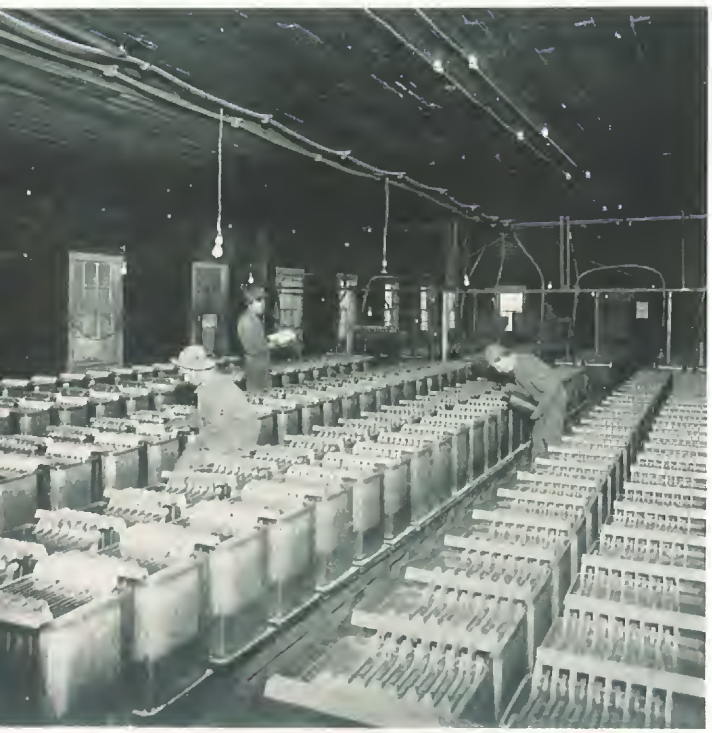
COMPOSITION

The antimony content of grid metal varies from 4% to 12% depending on the type of plate being cast. For automotive battery grids or all other grids which are thin and light in construction, the lead may contain between 8% and 12% antimony. An alloy of this composition imparts greater hardness and strength to the plate. At the same time, it facilitates machine casting because it possesses greater fluidity over a longer temperature range.

For casting heavy duty grids—those intended for farm-lighting, truck and stationary batteries—alloys containing 4% to 6% of antimony are satisfactory. Grids of this type are ordinarily of heavy construction and the usual practice is to cast them by hand rather than in casting machines.

Above: *Storage battery room in a large broadcasting studio. Note the lead grid inside the battery in the foreground.* Below: *Standard type of grid used in the automobile storage battery. The grid at the right is shown after pasting with lead oxide.*





Interior of the storage battery house at a large mine. The workmen are inspecting the batteries and bringing up the acid level in cells where needed.

CASTING TEMPERATURE

A temperature of 800° to 850° F. is a proper one for the machine casting of grids from 8-12% antimonial lead. For hand casting, a temperature approximately 50° F. higher may be necessary. The alloys containing 4-6% antimony require a casting temperature of 850° to 900° F.

TREATMENT AND TEMPERATURE OF MOLD

An improper preliminary treatment of the casting molds, or their operation at temperatures which are too high or too low, are frequent causes for defective grids.

The inner surfaces of the molds should first be coated either with a layer of acetylene smoke or a liquid spray compound. A "lubricant" of this latter type is manufactured by National Lead Company and is known as "Molspray."

A temperature of 350° to 450° F., depending upon the grid size and mold construction, is a satisfactory working temperature for machine operated molds. Hand operated molds might require some external heat, especially in the early stages of casting, to attain a good working temperature. Molds which are too hot delay solidification of the metal. Molds which are not hot enough may result in the production of grids with missing ribs.

TREATMENT OF GRIDS

Grids freshly cast—even from 12% antimonial lead—are quite soft. The usual practice is to "age" grids for three to six days before pasting them. This is especially necessary with the thinner grids or those intended for machine pasting. "Aging" is most readily accomplished by allowing the grids to stand at room temperature for the specified period.

GRID METAL SPECIFICATIONS OF VARIOUS BATTERY MANUFACTURERS

Specifications	Manufacturer							
	A	B	C	D	E	F	G	H
Antimony—Nominal	11.5	12.	9.	9.5	10.	9.5	8.	10.
Tin—Minimum	.45	.15	.20	.25	....	.25	.15	.25
Maximum	.55	.25	.30	.50	.40	.50	.45	.40
Arsenic—Minimum	.08	....	....	....	....	.08	....	....
Maximum	.12	.15	.08	.10	.2	.15	.075	.10
Copper—Maximum	.10	.08	.08	.05	.10	.10	.075	.08
Bismuth—Maximum	.005	.05	.05	.05	.025	.005	.005	....
Nickel—Maximum	.01	.01	.01	.0015	....	.01	.005	....
Zinc—Maximum	None	....	.005	.0015	.001	....	.005	....
Silver—Maximum	.0015	.01	....	.0015	....	....	None	....
Iron—Maximum	....	.01	.005	.01	.01	....	.005	....
Sulphur—Maximum	....	.005	....	....	....	....	....	....
Manganese—Maximum	....	....	.005	....	.001	....	....	....
Lead	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance

ZINC BASE ALLOYS
for die or slush casting

Zinc base alloys are used by die casters and slush casters in the fabrication of a wide variety of articles for many different purposes. The objects cast range from certain types of tools and machinery parts to household utensils and ornaments. The alloys contain—in addition to zinc—aluminum, copper or magnesium, varied according to the required physical properties of the finished casting. They are superior to many other metals or alloys which might be used for the purpose.

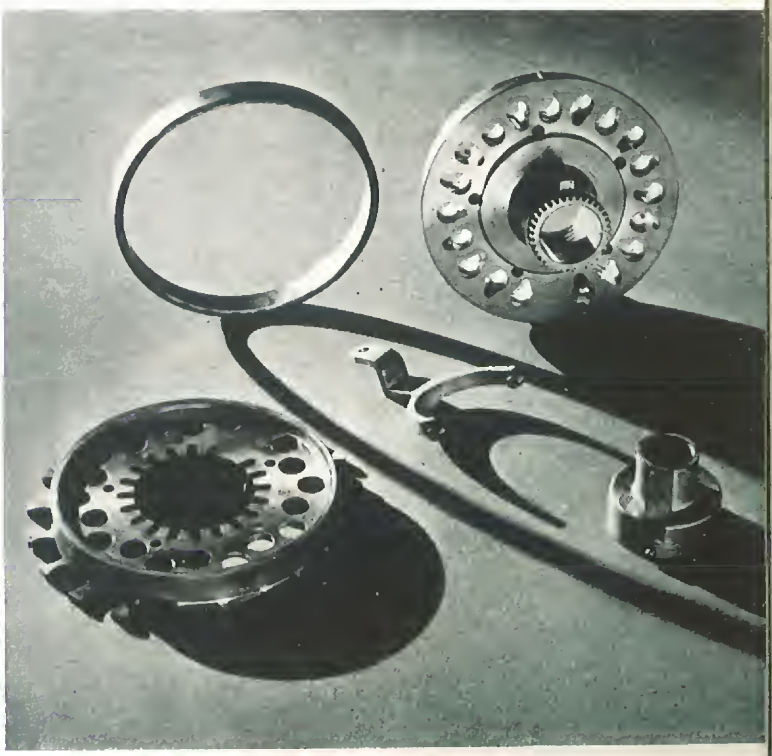
They have excellent casting qualities and a relatively low casting temperature. Melting between 725°F-800°F according to composition, they flow smoothly and readily and present a good surface finish. They take plated, lacquered or enameled finishes equally well. Their physical strength, exceeding most other soft metal alloys, is ample for practical purposes.

For pressure or die casting, we manufacture four standard alloys which cover a range from maximum physical strength to extreme fluidity. These alloys are designated as 123-X, 124-M, 124-S and 124-C. Their physical properties are indicated on the page that follows. We also produce other alloys, developed by our technical men in collaboration with the manufacturer who may require an alloy of a different composition for a particular type of casting.

For slush casting, we manufacture two standard alloys designated as 126-X and 126-C. The physical properties of these alloys, particularly as regards flow, differ from the physical properties of pressure casting alloys due to the nature of the process. Here the alloy is poured into the mold without pressure. As the alloy in contact with the mold hardens, the latter is inverted and the molten core is poured out leaving a hollow casting.

All our zinc base alloys are guaranteed to be made only from metals of the required purity.

Typical castings made from National Lead Company's die casting alloys. Note the good surface finish of objects above; the intricacy of castings below.

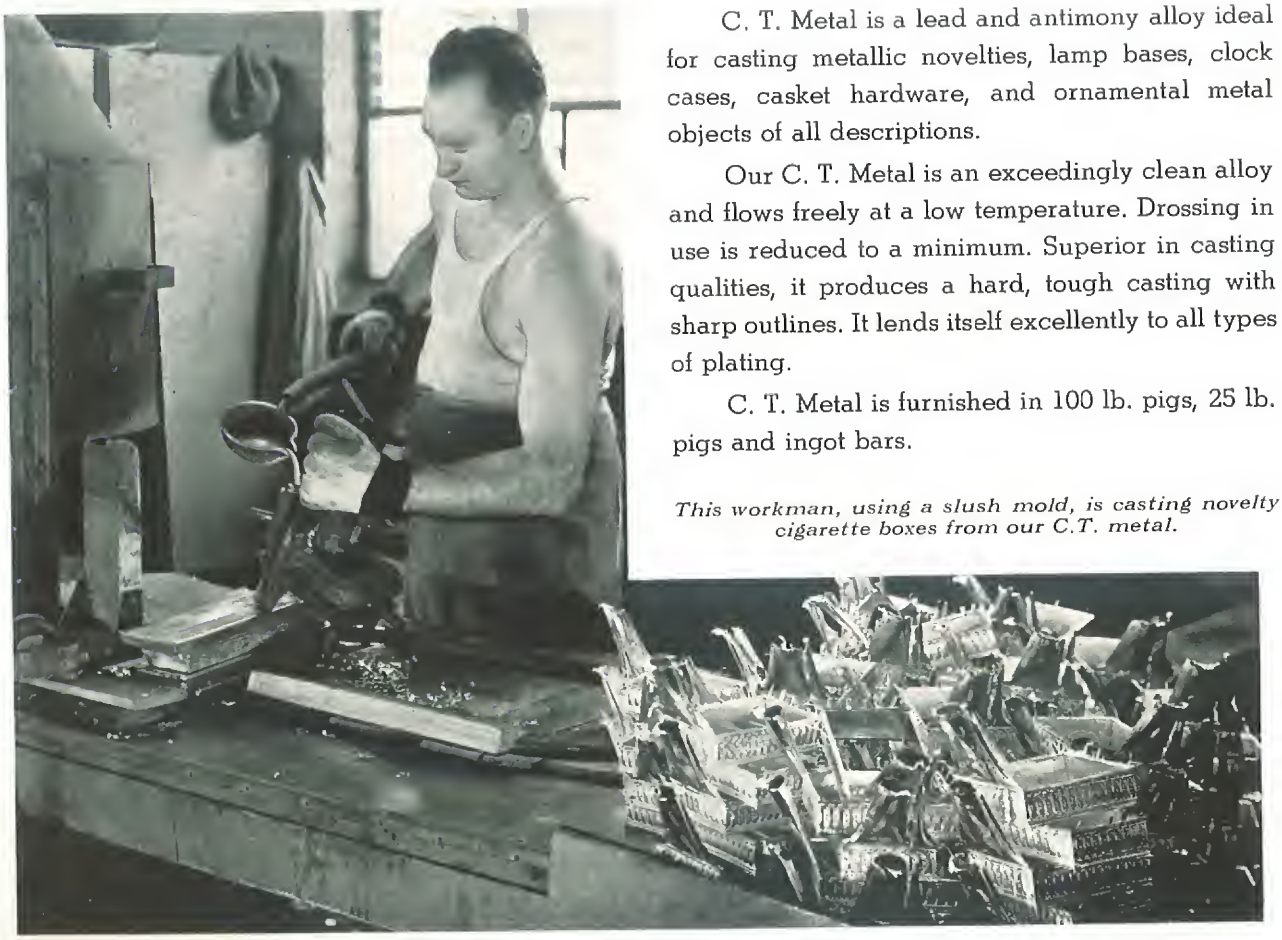


They are skillfully alloyed under ideal foundry conditions, designed to eliminate all danger of contamination thus insuring continued uniformity and strict adherence to the proper and desired chemical composition. The alloys are furnished in 7 lb. bars packed in 500 lb. boxes.

APPROXIMATE DATA ON NATIONAL LEAD COMPANY DIE CASTING ALLOYS

	123-X	124-M	124-S	124-C
Tensile Strength—Lbs./Sq. In	42,000	33,000	38,000	37,000
Impact Strength (Charpy) as measured on ¼" x ¼" bar	12.00	11.00	14.50	15.00
Elongation—% in 2 Inches	2.5	3.0	3.5	6.0
Compressive Strength—Lbs./Sq. In	93,100	60,500	87,300	91,700
Brinell Hardness	83	62	73	71
Specific Gravity	6.754	6.644	6.675	6.717
Melting Point	734°F.	728°F.	727°F.	732°F.

C. T. METAL



C. T. Metal is a lead and antimony alloy ideal for casting metallic novelties, lamp bases, clock cases, casket hardware, and ornamental metal objects of all descriptions.

Our C. T. Metal is an exceedingly clean alloy and flows freely at a low temperature. Drossing in use is reduced to a minimum. Superior in casting qualities, it produces a hard, tough casting with sharp outlines. It lends itself excellently to all types of plating.

C. T. Metal is furnished in 100 lb. pigs, 25 lb. pigs and ingot bars.

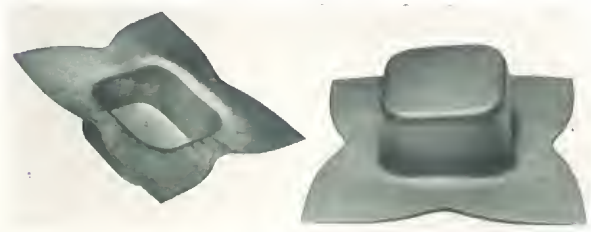
This workman, using a slush mold, is casting novelty cigarette boxes from our C.T. metal.

KIRKSITE A*

This special zinc-base alloy is the ideal material from which to make dies for forming, blanking and trimming sheet materials and for molding plastics. Kirksite A may be used as sand-cast for forming and trimming dies and, in the rolled form, may be used for blanking dies for sheet metal, fibre and other sheet stock, and for plastic molds made in sand or casting plaster.

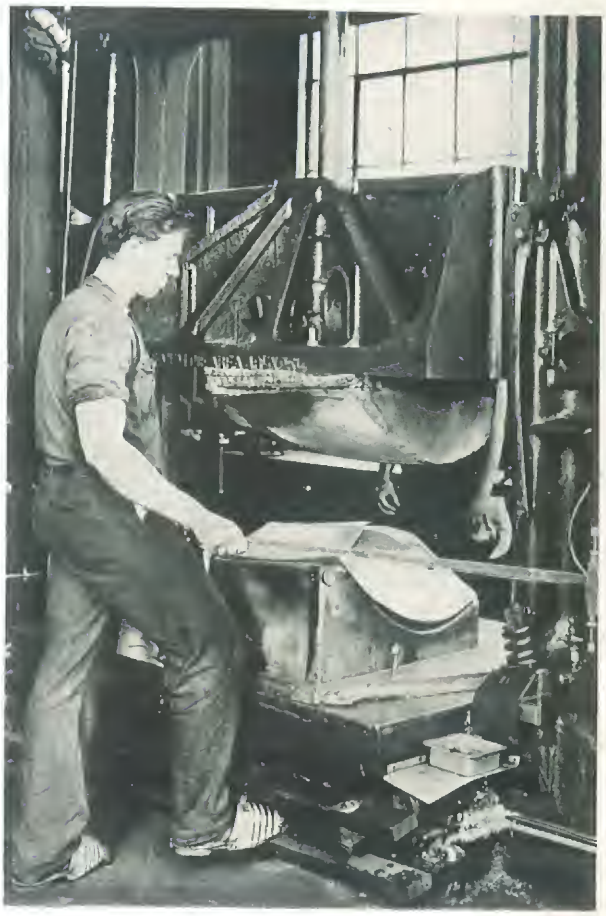
Right and left hand upper front door sill stampings, made of .037" deep-drawing body steel. 18,000 pairs were produced from die sets of Kirksite A. Two-foot Kirksite A shrinkage rule indicates relative size of stampings.

Using .062" steel, 1800 of these parts were blanked on one rolled Kirksite A die and formed on punch and die of cast Kirksite A. (Pencil indicates relative size.)



These stampings give proof of the toughness of Kirksite A forming dies. The stock is .091" stainless steel. The depth of the draw in the stampings is 2½ inches.

*Trade Mark Registered in U.S. Patent Office by Morris P. Kirk & Son, Inc., a subsidiary of National Lead Company.



Dies made of this material are in commercial use in almost all kinds of presses, from rope and air drop-hammers through hydropresses and brakes, to mechanical presses of toggle, crank and double acting types. They are being used without "pressure rings" or "binders" as well as with such clamping devices made of Kirksite A or of steel.

Kirksite A is best suited for short or medium production runs of stampings for the aircraft and automotive field; housings for household appliances; vending and office machines; metal furniture and fixtures; toys and novelties. This modern alloy has a special appeal for those who wish to experiment with various models of their wares to determine the buying public's reactions before going into full-scale tooling-up on any specific model. With Kirksite A this preliminary "sampling"

production can be accomplished easily, quickly and economically.

Kirksite A is available in both ingot and rolled (sheet) form. We will be glad to send complete information on this versatile die material to those who indicate an interest in its possibilities.

Below: A tube-bending device which utilizes Kirksite A for both the form-block and the shoe. Right: A group of cast Kirksite A chuck jaws (in background), and various fittings fastened to separating plates ready to be used as part of the mold in which the jaws are cast.

KIRKSITE DIE PLANT

We maintain a modern plant completely equipped for the prompt production of all types of Kirksite tooling, i.e., blanking, forming and plastic molding dies, and special tools for bending, assembling and machining operations. The shop can start with sketches, prints, models or hand-made parts provided by the customer or the necessary models and patterns can be produced in the shop itself.

The up-to-date methods employed in the die plant are designed to produce efficient tools promptly and economically.

Large Kirksite die set made in our shop. The punch, weighing 18 tons, and the die, weighing about 16 tons, were designed for use in stamping auto body roof panels. Together with the blank holder, not illustrated, the die set weighed about 84,000 lbs.

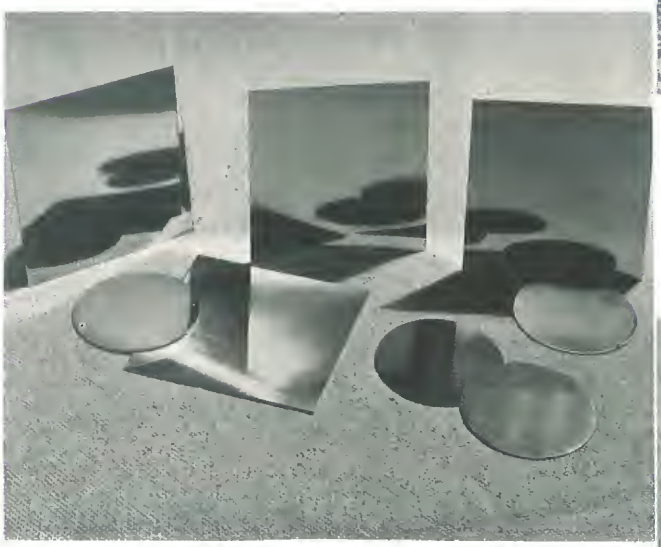
PEWTER

Pewter—sometimes called Britannia Metal—is a lead-free alloy, composed principally of tin with small amounts of antimony and copper. Considerably harder than pure tin, it is a highly ductile and malleable metal and can be readily fabricated, by casting, drawing, spinning or hand manipulation, into a variety of objects.

Pewter is widely used by manufacturers of flat ware and hollow ware. Because of its easy working qualities, it is also used in large quantities by amateur metal craftsmen and students in art metal courses in schools and colleges.

One of the chief attractions of a fabricated pewter object is its fine appearance. The alloy resembles silver and takes the same high polish, although, having a lower light-reflective property, it has a somewhat darker cast. Pewter articles are hard enough to withstand every-day use without becoming seriously marred or dented.

Pewter is furnished in either rectangular sheets or circular discs. The discs range in diameter from 2″ to 20″ and come in gauges from 14 to 20. Rectangular sheets are obtainable in these same gauges in any size up to 24″ x 36″. A table showing the complete range of gauges and sizes is given on the following page.



Above and Below: *Types of utensils commonly executed in pewter. The punch bowl and ladle above, the work of an amateur metal craftsman, was selected by the American Federation of Arts for exhibition at the 1937 World's Exposition in Paris, France.*
Left: *Our pewter is supplied in rectangular sheets and discs as shown. Note the high gloss.*

SIZES AND WEIGHTS OF PEWTER SHEETS* AND DISCS

Gauge	20 ga.	19 ga.	18 ga.	17 ga.	16 ga.	15 ga.	14 ga.
Thickness	.031 in.	.035 in.	.040 in.	.045 in.	.050 in.	.057 in.	.064 in.
Weight of Discs of Following Diameters							
2 in	1/3 oz.	2/5 oz.	1/2 oz.	3/5 oz.	2/3 oz.	3/4 oz.	4/5 oz.
3 in	1 oz.	1 1/10 oz.	1 1/4 oz.	1 2/5 oz.	1 1/2 oz.	1 3/4 oz.	2 oz.
4 in	1 3/4 oz.	2 oz.	2 1/4 oz.	2 1/2 oz.	2 7/8 oz.	3 1/5 oz.	3 2/3 oz.
5 in	2 2/3 oz.	3 oz.	3 1/2 oz.	4 oz.	4 1/3 oz.	5 oz.	5 2/3 oz.
6 in	3 2/3 oz.	4 1/5 oz.	4 3/4 oz.	5 1/3 oz.	6 oz.	6 4/5 oz.	7 3/4 oz.
7 in	5 1/8 oz.	6 oz.	6 3/4 oz.	7 3/5 oz.	8 1/2 oz.	9 2/3 oz.	11 oz.
8 in	6 2/3 oz.	7 3/4 oz.	8 3/4 oz.	9 7/8 oz.	11 oz.	12 1/2 oz.	14 1/4 oz.
9 in	8 1/2 oz.	10 oz.	11 1/4 oz.	12 2/3 oz.	14 oz.	16 1/8 oz.	18 1/4 oz.
10 in	10 1/4 oz.	11 7/8 oz.	13 1/2 oz.	15 1/8 oz.	16 7/8 oz.	19 1/3 oz.	22 oz.
11 in	12 1/2 oz.	14 1/2 oz.	16 1/2 oz.	18 1/2 oz.	20 2/3 oz.	23 2/3 oz.	26 7/8 oz.
12 in	15 oz.	17 1/4 oz.	19 2/3 oz.	22 oz.	24 1/2 oz.	28 1/8 oz.	31 7/8 oz.
13 in	17 1/2 oz.	20 1/4 oz.	23 oz.	25 7/8 oz.	28 3/4 oz.	33 oz.	37 1/3 oz.
14 in	20 1/3 oz.	23 1/2 oz.	26 3/4 oz.	30 oz.	33 1/2 oz.	38 1/3 oz.	43 1/2 oz.
15 in	23 1/3 oz.	27 oz.	30 3/4 oz.	34 1/2 oz.	38 1/2 oz.	44 1/8 oz.	50 oz.
16 in	26 2/3 oz.	30 7/8 oz.	35 oz.	39 1/3 oz.	43 3/4 oz.	50 1/5 oz.	56 7/8 oz.
17 in	29 7/8 oz.	34 1/2 oz.	39 1/4 oz.	44 1/8 oz.	49 oz.	56 1/3 oz.	63 3/4 oz.
18 in	33 2/3 oz.	39 oz.	44 1/4 oz.	49 3/4 oz.	55 1/3 oz.	63 1/2 oz.	72 oz.
19 in	37 2/5 oz.	43 1/3 oz.	49 1/4 oz.	55 2/5 oz.	61 1/2 oz.	70 2/3 oz.	80 oz.
20 in	41 1/2 oz.	48 oz.	54 1/2 oz.	61 1/3 oz.	68 1/8 oz.	78 1/4 oz.	88 1/2 oz.
*Weight of Sheets per Sq. Ft.	19 oz.	22 oz.	25 oz.	28 1/8 oz.	31 1/4 oz.	35 7/8 oz.	40 5/8 oz.

When ordering specify quantity of discs or sheets and gauge. Sheets may be ordered any size not exceeding 24" x 36". A price list for pewter sheets and discs will be mailed upon request.

GASKET METAL

Gasket Metal is a special alloy designed for sealing joints in refrigerating machinery, particularly for the joints of compressors where carbon dioxide or some similar gas is used as the refrigerant.

Our special Hoyt No. 8 Gasket Metal was developed by us in close collaboration with the largest manufacturers of refrigerating machinery in the country. Of correct composition, it makes a gasket hard enough to resist compression yet not so hard as to be brittle. Gaskets cut from this metal can be used on either the warm or the cold end of the compressor.

Gasket Metal is furnished in the following thicknesses: .006", .010", .015", and .029". It is packed flat in special boxes to prevent damage in shipment. In ordering this metal, it is a good plan to state size and number of gaskets to be cut. We will then send sheets of a size and shape that will cut with a minimum of waste.

ANTIMONY

Antimony possesses the property of increasing the hardness of metals with which it is alloyed and thus has a wide commercial use. We can furnish pure antimony of any brand desired. It comes in cakes varying from 40 lbs. to 55 lbs. depending upon brand.

SLAB ZINC (Spelter)

Prime zinc after smelting but before refining. Used widely for brazing and galvanizing purposes. We supply this grade of zinc in slabs weighing approximately 60 lbs.

BLOCK TIN PRODUCTS

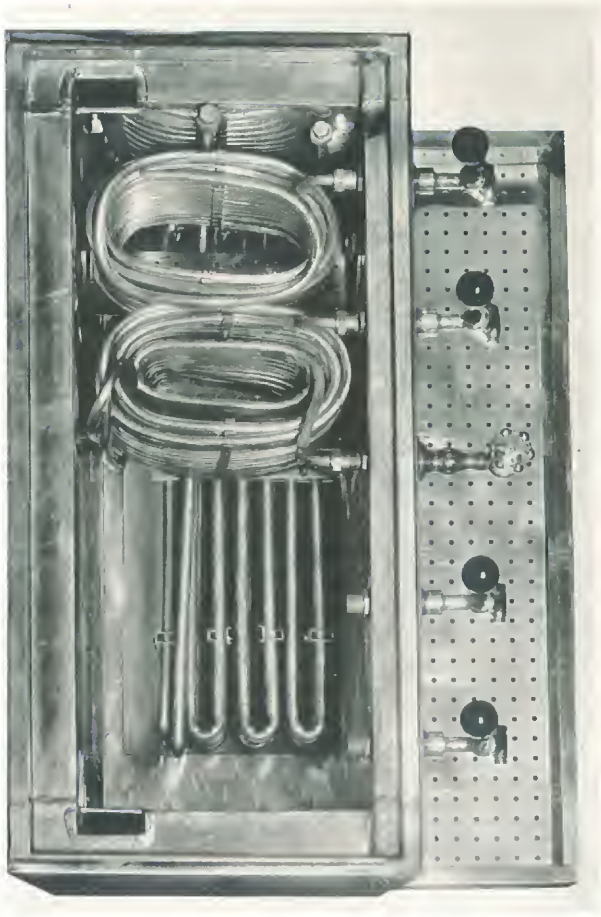
The term "block tin" indicates that the pipe or tube is of pure and solid tin. The wide use of tin-plated metals has resulted in a misconception of the true nature and properties of tin, especially as to durability. In the metal trade, it has long been the custom to refer to pure and solid tin as block tin.

TIN PIPE

While tin pipe has many and varied uses, its most important applications are in beer dispensing apparatus, soda fountain installations, handling distilled water and for all types of equipment handling liquids intended for human consumption. Tin pipe does not rust, tarnish or corrode, and therefore does not contaminate most of the liquids regularly passed through it. The ease with which tin pipe can be bent or coiled is an additional advantage in this connection.

We manufacture tin pipe in a variety of sizes and weights. A selected list is given below. Other sizes and weights can be furnished on short notice. Our tin pipe can be depended upon to be uniform in wall thickness and free from hard and soft spots or other imperfections.

Block tin pipe is supplied in straight lengths, on coils or on reels as specified on the order.



Beer dispensing unit with the top removed to show block tin pipe cooling coils.

BLOCK TIN PIPE—APPROXIMATE SIZES AND WEIGHTS

Inside Diam., In.	Outside Diam., In.	Weight per Ft., Oz.	Inside Diam., In.	Outside Diam., In.	Weight per Ft., Oz.	Inside Diam., In.	Outside Diam., In.	Weight per Ft., Oz.
1/16	1/8	1/2	3/8	17/32 S	5	5/8	25/32 S	8
				17/32 F	6		25/32	9
1/8	3/16	3/4		9/16	7		13/16 S	10
				19/32 S	8		7/8 S	14
3/16	1/4 F	1 1/2		19/32 F	9			
	5/16	2 1/2		5/8	10	3/4	7/8	8
				21/32	12		29/32	10
1/4	3/8	3					29/32 F	11
	13/32	4	7/16	17/32 F	4		15/16 S	12
	7/16	5		19/32 S	6		31/32 F	16
	15/32 S	6		5/8	8		1	17
	1/2 S	7					1 1/32	20
	1/2 F	8	1/2	19/32 F	4 1/2			
				5/8 S	5	1	13/32 F	9
5/16	7/16 F	4		5/8	5 1/2		15/32 F	14
	1/2 S	5 1/2		5/8 F	6		13/16	16
	17/32	7 1/2		21/32	7		13/16 F	18
	17/32 F	8		21/32 F	8		17/32 F	20
				23/32 S	10		1 1/4	22
3/8	1/2 S	4		3/4 S	12			
	1/2	4 1/2						

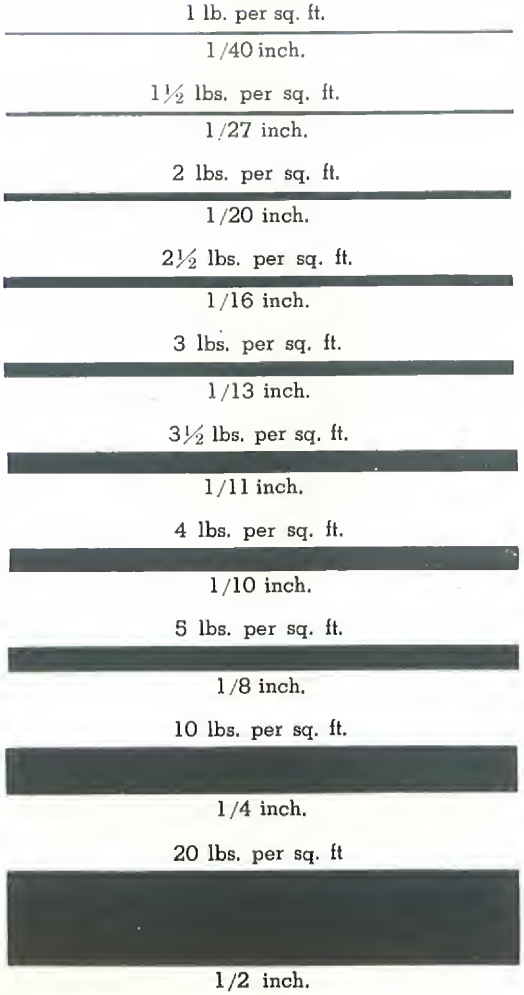
F: Full. S: Scant.

TIN SHEET

Tin in sheet form is used extensively by soda tank manufacturers and as the lining material in tanks and vats employed in the preparation and handling of drugs, food products and various chemicals. Tin sheet does not corrode nor does it contaminate substances in contact with it. It is easily worked and thus easy to install.

We manufacture sheet tin by a milling process from specially refined, primary metal. It can be supplied in practically any thickness and size up to a width of 8 feet. Small size sheets are shipped flat and carefully packed to avoid damage. Large size sheets are shipped on rolls.

SIZES AND WEIGHTS OF SHEET TIN



TIN ANODES

Our tin anodes are made from the highest grade, refined metal only. Highly polished and free from imperfections, they provide uniform distribution in the acid bath and wear down evenly.

Anodes are supplied in any size and shape specified in the order. They are carefully packed for protection in shipping.

TIN WIRE

An important use for tin wire is in spray guns for the application of metallic coatings. We can supply pure refined tin wire for this and other purposes in all standard wire gauges.

TIN TAPE

Tin tape is an extruded product and can be furnished in practically any width and thickness desired. It is furnished on spools or reels according to the weight of the shipment or the specification of the purchaser.

PULVERIZED TIN

Pulverized or powdered tin is used principally for the pre-tinning operation in delicate soldering work. We furnish pulverized tin in three meshes—50, 100 and 200. It is packed in tins or bulk containers.

BAR TIN

We furnish pure refined tin cast in bar form. These bars, which weigh approximately 1 lb. each, are widely used by plumbers for enriching solder. They are carefully packed in boxes of any weight desired by the customer.

INGOT TIN

Pure refined tin is also obtainable in rectangular ingot form. Each ingot weighs approximately 5 lbs.

PIG TIN

We also supply pure tin cast in pig form for large users. Pigs weigh approximately 100 lbs.

CHEMICAL CORROSION RESISTANCE OF LEAD

Lead may be economically employed with many of the chemicals used in the process industries. The following partial list of such chemicals with brief comments on the reactions they may be expected to have with lead is intended as a general guide in the selection of materials of plant construction. Because of the broad range of chemicals and the wide variation of operating conditions existing in modern industry a more complete and more specific list would be impractical.

ACETIC ACID. Moderately corrosive to lead, but corrosion is greatly accelerated by high velocities and temperatures. Acetic anhydride and glacial acetic acid are handled in lead.

ACETONE. Lead may be used satisfactorily.

ACETYLENE. Little effect on lead.

ALCOHOL, ETHYL. No effect on lead.

ALCOHOL, METHYL. No effect on lead.

ALUMINUM SULPHATE or ALUM. Lead may be used satisfactorily.

AMMONIA. Lead is unaffected by the dry gas, and by liquid unless sodium or potassium are dissolved in it.

AMMONIUM AZIDE. No effect on lead.

AMMONIUM CHLORIDE. Lead may be used at ordinary temperatures with concentrations up to 10 per cent.

AMMONIUM HYDROXIDE. Lead satisfactory with liquid or gas at practically all temperatures and concentrations.

AMMONIUM PHOSPHATE. Lead may be used satisfactorily.

AMMONIUM SULPHATE. Lead may be used satisfactorily.

ANTIMONY CHLORIDE. Lead is somewhat corroded, but is used with comparative economy for chlorinating the tri-chloride to the pentachloride.

BENZYL CHLORIDE. Lead may be used satisfactorily.

BORIC ACID. Lead may be used satisfactorily.

BRINE. (See Sodium Chloride.)

BROMINE. Lead may be used when cold and acid free.

CALCIUM CARBONATE. Found in natural waters and forms a good protective coating on lead. Added to water to reduce plumbo-solvency.

CALCIUM HYDROXIDE. Presence in green cement corrodes lead in presence of moisture and oxygen. However, added to soft waters reduces plumbo-solvency.

CARBONATES, SOLUBLE. Act as a protection to lead in natural waters unless present in excess, when it increases solubility. Lead is used in acid carbonate systems for generating CO_2.

CHLORINATED HYDROCARBONS. Action on lead varies from slight to severe depending upon breakdown to HCl and presence of organic acids.

CHLORINATION PROCESSES. Lead is slowly corroded at temperatures usually used, but has satisfactory life and greater economy compared with other common metals.

CHLORINE. Dry does not affect lead and lead may be used with moist chlorine up to about 110°C. with slight corrosion. Amounts of chlorine used in water treatment do not affect lead.

CHROMIC ACID. Lead may be used with fairly high concentrations of this acid. Tellurium-Antimony Lead or Antimony Lead are preferred for use as anodes, heating pipes and tank linings in chromium electroplating work. For prolonged life of lead equipment, anodizing is recommended to aid in the formation of an adequate protective coating.

CINDERS. Lead embedded in cinders should be protected.

COAL TAR. Lead used in refining and recovery of many by-products.

CONCRETE, CEMENT or MORTAR. When green, free lime present attacks lead. Aging to carbonate lime or applying asphalt coating on lead recommended to prevent such corrosion.

COPPER SULPHATE. Lead is used for anodes and tank linings in electrorefining, electroplating and electroforming equipment, and is preferred for acid solutions.

ETHER. Little or no effect on lead. Lead used in its manufacture.

FERROUS SULPHATE. Lead used for tank linings and coils in production and use.

FORMALDEHYDE (Formic Acid). Action on lead similar to that of acetic acid.

HYDROCHLORIC ACID. Use of lead is not generally recommended but it has been used with some corrosion in concentrations up to 30% at normal temperatures and 20% at 100°C. Antimonial lead shows better resistance than ordinary lead.

HYDROFLUORIC ACID. Lead is commonly used and has fair resistance to dilute acid.

HYDROGEN CHLORIDE (Anhydrous Hydrochloric Acid). Little effect on lead.

HYDROGEN PEROXIDE. Not likely alone to affect lead, but accelerates acid corrosion.

KOCH ACID REDUCTION MASS. Lead may be used satisfactorily.

MAGNESIUM CHLORIDE. Corrodes lead as it does other metals.

MALACHITE GREEN MOTHER LIQUOR. No appreciable effect on lead at 80°C.

MIXED ACIDS. Mixtures of sulphuric and nitric acids can be used with lead at ordinary temperatures if water present is less than 30%.

NAPHTHALENE. No effect on lead.

NITRATION MIXTURE of H-ACID. Lead is used with rather high corrosion.

NITRIC ACID. Lead is not generally recommended with this acid, but is used with little corrosion when concentrations are above 80% at normal temperature.

NITRO-BENZOL and NITRO-CHLOR-BENZOL. Corrosive to lead.

NITROCELLULOSE. Lead widely used as in all rayon manufacturing processes.

NITROGLYCERINE. Lead used to handle spent acid.

NITROSYL-SULPHURIC ACID. Action on lead is least at specific gravity of about 1.5 to 1.6. Close control thus minimizes corrosion.

ORGANIC ACIDS. In general, accelerate the corrosion of lead, but their presence in solutions does not always preclude the use of lead.

OXYGEN. Dry gas merely tarnishes lead. In presence of water, initial attack is usually followed by formation of protective coating formed by salts such as carbonates, sulphates and silicates in the water. In the absence of these salts, deaeration may be employed to remove oxygen because of its action on all metals.

OXY-L ACID. Lead is corroded to some extent but is about the only economical metal that can be used with satisfaction.

PHENOL. Lead may be used satisfactorily.

PHOSPHORIC ACID. Lead may be used with concentrations up to 80% below 200°C. Impure acid has even less effect on lead and can be used up to 85% concentration.

PHOTOGRAPHIC SOLUTIONS. Lead is satisfactory generally.

POTASSIUM PERMANGANATE. Attacks lead.

PYRIDENE. Does not affect lead.

SILICATES. Form protective coatings on lead and thus can be recommended for treating natural waters if necessary.

SODIUM BISULPHATE. Can be handled in lead when highly concentrated.

SODIUM CARBONATE. Dilute solutions do not affect lead; in natural waters forms protective coating on lead.

SODIUM CHLORIDE. Lead satisfactory for dilute solutions at ordinary temperatures. Sea water and brine are commonly handled in lead or antimonial lead.

SODIUM HYDROSULPHITE. Lead may be used satisfactorily.

SODIUM HYDROXIDE. Lead can be used with concentrations up to 25% and temperatures of 80°C.

SODIUM HYPOCHLORITE. Attacks lead.

SODIUM HYPOSULPHITE. Lead can be used satisfactorily.

SODIUM SULPHATE. Lead can be used satisfactorily with solutions up to 10% concentration boiling.

SODIUM SULPHIDE. Lead can be used satisfactorily with these solutions at temperatures up to 100°C.

SODIUM SULPHITE. Lead can be used with solutions up to 20% concentration at 25°C.

SULPHUR CHLORIDE. Has little effect on lead.

SULPHUR DIOXIDE. Has little effect on lead when dry and can be used moist up to about 200°C.

SULPHURIC ACID. Lead is the standard material for handling this acid. It can be used with concentrations up to 96% at room temperature and 85% up to 220°C. It is sometimes used satisfactorily even up to 250°C.

SULPHUROUS ACID. Lead is satisfactory up to about 220°C.

TANNIC ACID. Somewhat similar to acetic acid.

TARTARIC ACID. Somewhat similar to acetic acid.

THIONYL CHLORIDE. Lead is used satisfactorily up to 220°C. and sometimes higher.

TITANIUM SULPHATE. Solutions can be handled satisfactorily in lead.

VICTORIA GREEN MOTHER LIQUID. Lead may be used satisfactorily up to 80°C.

WATER, DISTILLED. Dissolves lead very slowly in proportion to amount of dissolved oxygen.

WATER, NATURAL. Usually no effect on lead because of protective coating formed from dissolved salts. Very soft waters or those of peaty origin may dissolve lead slightly, as they do other metals, and such action can be prevented by treatment of the waters with lime or sodium silicate.

WOOD. Most wood has little or no corrosive effect on lead. A few instances of corrosion by wood containing organic acids, such as green oak, have been reported. Wood to be lined with lead should be inspected for presence of borers.

ZINC CHLORIDE. Lead can be used satisfactorily.

CHEMICAL FORMULAS OF COMMONLY USED LEAD COMPOUNDS*

CHEMICAL NAME	COMMON OR TRADE NAME	FORMULA	PRACTICAL APPLICATION
Hydrated Basic Lead Carbonate	White Lead	$2PbCO_3—Pb(OH)_2$	The most widely used of lead pigments. Also used in glazing pottery and enameled ware, in putty and in the manufacture of orange mineral.
Basic Lead Sulphate, White		$2PbSO_4.PbO$ (Approx.)	Used extensively in the mixed paint industry, and also as an accelerator of vulcanization in the manufacture of rubber.
Basic Lead Sulphate, Blue		$2PbSO_4.PbO$ (Approx.) Colored by small quantities of lead sulphide and carbon	The principal use of blue basic lead sulphate is in the manufacture of paint for steel.
Lead Monoxide	Litharge	PbO	Used in the manufacture of Battery Plates, Glass, Colors, Rubber, Varnish, Pottery, and in the refining of Oil.
Triplumbic Tetroxide	Orange Mineral	Pb_3O_4	Used largely by color makers and manufacturers of printing inks.
Triplumbic Tetroxide	Red Lead	Pb_3O_4	Next to white lead the most widely used lead paint pigment. Red Lead is the world's standard paint for protecting iron and steel against corrosion.
Lead Chromate	Medium Chrome Yellow	$PbCrO_4$	Used in the manufacture of paint and colors. By varying the conditions of manufacture other lead chromates such as Orange Chrome Yellow, Chrome Red and Chrome Green may be produced.
Lead Acetate	Sugar of Lead	$Pb(C_2H_3O_2)_2.—3H_2O$	Used in the manufacture of other lead salts, mordant in dyes, drier in paints, lead coating steel.
Lead Antimonate		$Pb_3(SbO_4)_2$	Used as pigment in paint, ceramics, crockery and glass industries.
Lead Arsenate		$Pb_3(AsO_4)_2$	Insecticide.
Lead Azide		PbN_6	Used as primer in explosives with nitroglycerine.
Lead Borate		$Pb(BO_2)_2.H_2O$ $PbO.3B_2O_3$	Used as drier in paints. Also used in glazes and enamels.
Lead Carbonate	Cerrusite	$PbCO_3$	Mineral occurring in nature from which lead is sometimes produced.
Lead Dithiofurate		$Pb(C_4H_3OCSS)_2$	Accelerator in manufacture of rubber.
Lead Fluosilicate		$PbSiF_6$	Solution of about 8% $PbSiF_6$ and 11% H_2SiF_6 used as electrolyte in electrolytic refining of lead.
Lead Linoleate		$Pb(C_{18}H_{31}O_2)_2$	Principally used as drier in paint and varnish. For this purpose it is dissolved in turpentine while warm.
Lead Nitrate		$Pb(NO_3)_2$	Used in manufacture of other lead salts, matches, fireworks, insecticides.
Lead Oleate		$Pb(C_{18}H_{33}O_2)_2$	Used as drier in varnish. Also used in rubber and lubricants.
Lead Resinate		$Pb(C_{20}OH_{29}O_2)_2$	Principally used as drier in paints. For this use it is dissolved in petroleum solvent or mixture of turpentine and petroleum thinner.
Lead Stearate		$Pb(C_{18}H_{35}O_2)_2$	Used as a drier in varnish and lacquer.
Lead Sulphate (plumbous)	Anglesite	$PbSO_4$	Mineral occurring in nature from which lead is sometimes produced.
Lead Sulphide	Galena	PbS	Most common mineral from which lead is extracted.
Lead Sulphocyanate		$Pb(CNS)_2$	Used as primer in explosives.
Lead Tetraethyl		$Pb(C_2H_5)_4$	Used as anti-knock ingredient in motor fuels.
Sodium Plumbite	Doctor Solution	$NaPb(OH)_3$	Widely used in oil refining, referred to as "doctor solution".

*Compiled with the assistance of the Lead Industries Association.

DATA RELATIVE TO CHEMICAL LEAD PIPES FOR HEATING COILS

Inside Diameter of Pipe in Inches	Maximum Steam Pressure Lbs. per Sq. In.	Corresponding Temperature in °F.	Pipe Classification	Pipe Outside Diameter in Inches	Weight per Ft. Lbs. Ozs.	Sq. Ft. Surface Area per 100 Ft. Length
¾	30	274	C	1.006	1 – 12	26.3
¾	40	287	A	1.156	3	30.3
¾	50	298	AA	1.212	3 – 8	31.75
1	30	274	B	1.356	3 – 4	35.5
1	40	287	AA	1.492	4 – 12	39.05
1	50	298	Special	1.61	6 – 2	42.15
1¼	30	274	A	1.67	4 – 12	43.7
1¼	40	287	AAA	1.889	7 – 12	49.4
1¼	50	298	Special	2.012	9 – 10	52.65

SAFE WORKING PRESSURES

For Calculating Safe Working Pressure of Pipe at Various Temperatures

Temperature °C.	Temperature °F.	Equivalent Steam Gauge Pressure Lbs. per Sq In.	Maximum Allowable Fiber Stress in Lbs. per Sq. In. Tellurium or Chemical Lead	Maximum Allowable Fiber Stress in Lbs. per Sq. In. 6% Antimonial Lead
20	68	..	200	400
30	86	..	190	370
40	104	..	180	340
50	122	..	172	310
60	140	..	162	280
70	158	..	153	254
80	176	..	144	222
90	194	..	136	195
100	212	0	127	165
110	230	6	118	137
120	248	14	110	110
130	266	24	100	80
140	284	38	90	50
150	302	55	80	..
160	320	75	..	..
170	338	99	..	..
180	356	131	..	..
190	374	167	..	..
200	392	210	..	..
210	410	261	..	..
220	428	323	..	..
230	446	390	..	..
240	464	470	..	..
247	477	535	..	0
327	621	..	0	..

The formulas to be used with the above values are:

$$P = \frac{2\,ST}{D} \text{ or } T = \frac{PD}{2S}$$

Where P is the safe working pressure in lbs. per sq. inch
S is the maximum allowable fiber stress from above table
T is thickness of pipe wall in inches
D is internal diameter in inches.

Sometimes it is advisable to use wall thicknesses greater than those derived from the above equation for mechanical or structural reasons. Where corrosion is anticipated, it is well to provide additional wall thickness.

HEATING COIL FORMULA

For Calculating Length of Lead Pipe Needed for Heating Solutions—Time 1 hour

$$\text{Mean temperature difference °F.} = \frac{(T-T_1)-(T-T_2)}{2.3 \log_{10} \frac{(T-T_1)}{(T-T_2)}}$$

where T = Temperature of steam or heating medium in °F.
T_1 = Initial temperature of solution in °F.
T_2 = Final temperature of solution in °F.

$$\text{Length of pipe required} = \frac{V \times W \times (T_2-T_1) \times Sp \times 12}{H \times M \times D \times 3.1416}$$

where V = Volume of solution in gallons
W = Weight of solution in lbs. per gal.
T_2 = Temperature to which solution is to be heated in °F.
T_1 = Initial temperature of solution in °F.
Sp = Specific heat of solution
H = Heat transfer in B.t.u./sq. ft./°F./hr. = 150
M = Mean temperature difference °F.
D = Outside diameter of lead pipe in inches

NOTE: H varies with the thermal conductivity of the solution, the density of the solution and the amount of stirring. As a general figure H = 150 when convection currents function well or there is mild stirring. For a more thorough consideration of heat transfer problems, engineering books on the subject should be consulted.

TEMPERATURE CONVERSION

From Fahrenheit to Centigrade—Subtract 32, multiply by five-ninths.

From Centigrade to Fahrenheit—Multiply by nine-fifths, add 32.

(*Also see Page Q-13*)

FEET OF PIPE REQUIRED TO HEAT AQUEOUS SOLUTIONS

TIME FOR HEATING 62° F. TO 212° F.	NOMINAL PIPE OUTSIDE DIAMETER IN INCHES	STEAM PRESSURE IN LBS./SQ. IN. 3	10	25	50	100	150
		FEET OF PIPE PER GALLON					
½ Hr.	½	1.83	.99	.72	.54	.40	.32
	¾	1.38	.75	.55	.41	.30	.24
	1	1.08	.59	.43	.32	.24	.19
	1¼	.83	.45	.33	.24	.18	.15
	1½	.71	.38	.28	.21	.15	.12
	2	.55	.30	.22	.16	.12	.10
	2½	.46	.25	.18	.14	.10	.08
1 Hr.	½	.92	.50	.36	.27	.20	.16
	¾	.69	.38	.28	.21	.15	.12
	1	.54	.30	.22	.16	.12	.10
	1¼	.42	.23	.17	.12	.09	.08
	1½	.36	.19	.14	.11	.08	.06
	2	.28	.15	.11	.08	.06	.05
	2½	.23	.13	.09	.07	.05	.04

TIME FOR HEATING 62° F. TO 212° F.	NOMINAL PIPE OUTSIDE DIAMETER IN INCHES	STEAM PRESSURE IN LBS./SQ. IN. 3	10	25	50	100	150
		FEET OF PIPE PER GALLON					
2 Hrs.	½	.46	.25	.18	.14	.10	.08
	¾	.35	.19	.14	.11	.08	.06
	1	.27	.15	.11	.08	.06	.05
	1¼	.21	.12	.09	.06	.05	.04
	1½	.18	.10	.07	.06	.04	.03
	2	.14	.08	.06	.04	.03	.03
	2½	.12	.07	.05	.04	.03	.02

FLOW OF WATER IN HOUSE SERVICE PIPES

*(in cu. ft. per min.)**
Thomson Meter Co.

CONDITIONS OF DISCHARGE	PRESSURE IN MAIN LBS. PER SQ. IN.	NOMINAL DIAMETERS OF LEAD SERVICE PIPE IN INCHES ½″	⅝″	¾″	1″	1½″	2″
Through 35′ of Service Pipe, No Back Pressure	30	1.10	1.92	3.01	6.13	16.58	33.34
	40	1.27	2.22	3.48	7.08	19.14	38.50
	50	1.42	2.48	3.89	7.92	21.40	43.04
	60	1.56	2.71	4.26	8.67	23.44	47.15
	75	1.74	3.03	4.77	9.70	26.21	52.71
	100	2.01	3.50	5.50	11.20	30.27	60.87
	130	2.29	3.99	6.28	12.77	34.51	69.40
Through 100′ of Service Pipe, No Back Pressure	30	0.66	1.16	1.84	3.78	10.40	21.30
	40	0.77	1.34	2.12	4.36	12.01	24.59
	50	0.86	1.50	2.37	4.88	13.43	27.50
	60	0.94	1.65	2.60	5.34	14.71	30.12
	75	1.05	1.84	2.91	5.97	16.45	33.68
	100	1.22	2.13	3.36	6.90	18.99	38.89
	130	1.39	2.42	3.83	7.86	21.66	44.34
Through 100′ of Service Pipe and 15′ Vertical Rise	30	0.55	0.96	1.52	3.11	8.57	17.55
	40	0.66	1.15	1.81	3.72	10.24	20.95
	50	0.75	1.31	2.06	4.24	11.67	23.87
	60	0.83	1.45	2.29	4.70	12.94	26.48
	75	0.94	1.64	2.59	5.32	14.64	29.96
	100	1.10	1.92	3.02	6.21	17.10	35.00
	130	1.26	2.20	3.48	7.14	19.66	40.23
Through 100′ of Service Pipe and 30′ Vertical Rise	30	0.44	0.77	1.22	2.50	6.80	14.11
	40	0.55	0.97	1.53	3.15	8.68	17.79
	50	0.65	1.14	1.79	3.69	10.16	20.82
	60	0.73	1.28	2.02	4.15	11.45	23.47
	75	0.84	1.47	2.32	4.77	13.15	26.95
	100	1.00	1.74	2.75	5.65	15.58	31.93
	130	1.15	2.02	3.19	6.55	18.07	37.02

NOTE: In this table it is assumed that the pipe is straight and smooth inside, that the friction of the main and meter are disregarded, that the inlet from the main is of ordinary character, sharp, not flaring or rounded, and that the outlet is the full diameter of the pipe. The exact details of the conditions given are rarely met in practice, consequently the quantities of the table may be expected to be decreased, because bends may interpose, or stop-cocks may be used, or back pressure may be increased, etc.

*To find the discharge in gallons, multiply by 7.48.

SPECIFICATIONS FOR PIG LEAD ASTM (B29-43)

Chemical Requirements

	CORRODING LEAD*	CHEMICAL LEAD*	COMMON DESILVERIZED LEAD A*	SOFT UNDESILVERIZED LEAD*
Silver, max., per cent	0.0015	0.020	0.002	0.002
Silver, min., per cent	.....	0.002	.....	.....
Copper, max., per cent	0.0015	0.080	0.0025	0.04
Copper, min., per cent	.....	0.040	.....	.....
Silver and copper together, max., per cent	0.0025	.....	.....	.....
Arsenic, max., per cent	0.0015	.....	.....	.....
Antimony and tin together, max., per cent	0.0095	.....	.....	.....
Arsenic, antimony and tin together, max., per cent	.....	0.002	0.015	0.015
Zinc, max., per cent	0.0015	0.001	0.002	0.002
Iron, max., per cent	0.002	0.002	0.002	0.002
Bismuth, max., per cent	0.05	0.005	0.15	0.005
Lead (by difference), min., per cent	99.94	99.90	99.85	99.93

*Explanatory Note:

Corroding lead is a designation that has been used for many years in the trade to describe lead which has been refined to a high degree of purity.

Chemical lead has been used for many years in the trade to describe the undesilverized lead produced from Southeastern Missouri ores.

Common desilverized lead A is a designation that is used to describe fully refined desilverized lead.

Soft undesilverized lead is used in the trade to describe the type of lead produced from ores of the Joplin, Mo. district.

SPECIFICATIONS FOR SLAB ZINC (SPELTER) ASTM (B6-37)

Chemical Requirements

	SPECIAL HIGH GRADE	HIGH GRADE	PRIME WESTERN
Lead, max., per cent	0.007	0.07	1.60
Iron, max., per cent	0.005	0.02	0.08
Cadmium, max., per cent	0.005	0.07	....
Aluminum	None	None	....
Sum of lead, iron, cadmium, max., per cent	0.010	0.10	....

MELTING POINTS

	DEGREES C	DEGREES F	WEIGHT PER CUBIC INCH LBS.
Aluminum	652	1215	.0975
Antimony	630	1167	.2391
Bismuth	271	520	.3541
Brass {Copper −67, Zinc −33}	910–930	1670–1706	.3060
Cadmium	321	610	.3125
Chromium	1550	2822	.2579
Cobalt	1490	2714	.3216
Copper	1083	1982	.3230
Gold	1063	1946	.6973
Lead	327	621	.4090
Magnesium	651	1204	.0628
Manganese	1242	2268	.2680
Mercury	−39	−38	.4890
Nickel	1452	2646	.3220
Phosphorus	44	111	.0657
Platinum	1773	3224	.0774
Silver	960	1760	.3788
Steel	1375	2506	.2833
Sulfur	113	235	.0750
Tin	232	450	.2640
Tungsten	3370	6098	.6980
Zinc	419	787	.2580

EUTECTICS OF LEAD

Melting Point of Eutectics of Lead with Other Metals:

OTHER METAL	PER CENT BY WEIGHT	TEMP. ° C.
Silver.....Ag	2.3	304
Arsenic.....As	2.8	292
Gold.....Au	15	215
Barium.....Ba	4.5	291
Bismuth.....Bi	56.5	125
Cadmium....Cd	17.4	248
Magnesium..Mg	3	250
Palladium...Pd	5	265
Platinum....Pt	5	290
Antimony...Sb	12.5	251
Tin.....Sn	62	183
Zinc.....Zn	.5	318

INTERNATIONAL ATOMIC WEIGHTS, 1941*

	Symbol	Atomic Number	Atomic Weight
Actinium†	Ac	89	227
Alabamine†	Ab	85	221
Aluminum	Al	13	26.97
Americium†	Am	95	241
Antimony	Sb	51	121.76
Argon	A	18	39.944
Arsenic	As	33	74.91
Barium	Ba	56	137.36
Beryllium	Be	4	9.02
Bismuth	Bi	83	209.00
Boron	B	5	10.82
Bromine	Br	35	79.916
Cadmium	Cd	48	112.41
Calcium	Ca	20	40.08
Carbon	C	6	12.010
Cerium	Ce	58	140.13
Cesium	Cs	55	132.91
Chlorine	Cl	17	35.457
Chromium	Cr	24	52.01
Cobalt	Co	27	58.94
Columbium	Cb	41	92.91
Copper	Cu	29	63.57
Curium†	Cm	96	242
Dysprosium	Dy	66	162.46
Erbium	Er	68	167.2
Europium	Eu	63	152.0
Fluorine	F	9	19.00
Gadolinium	Gd	64	156.9
Gallium	Ga	31	69.72
Germanium	Ge	32	72.60
Gold	Au	79	197.2
Hafnium	Hf	72	178.6
Helium	He	2	4.003
Holmium	Ho	67	164.94
Hydrogen	H	1	1.008
Illinium†	Il	61	146
Indium	In	49	114.76
Iodine	I	53	126.92
Iridium	Ir	77	193.1
Iron	Fe	26	55.85
Krypton	Kr	36	83.7
Lanthanum	La	57	138.92
Lead	Pb	82	207.21
Lithium	Li	3	6.940
Lutecium	Lu	71	174.99
Magnesium	Mg	12	24.32
Manganese	Mn	25	54.93
Masurium†	Ma	43	99
Mercury	Hg	80	200.61
Molybdenum	Mo	42	95.95
Neodymium	Nd	60	144.27
Neon	Ne	10	20.183
Neptunium†	Np	93	237
Nickel	Ni	28	58.69
Nitrogen	N	7	14.008
Osmium	Os	76	190.2
Oxygen	O	8	16.0000
Palladium	Pd	46	106.7
Phosphorus	P	15	30.98
Platinum	Pt	78	195.23
Plutonium†	Pu	94	239
Polonium†	Po	84	210
Potassium	K	19	39.096
Praseodymium	Pr	59	140.92
Protactinium	Pa	91	231
Radium	Ra	88	226.05
Radon	Rn	86	222
Rhenium	Re	75	186.31
Rhodium	Rh	45	102.91
Rubidium	Rb	37	85.48
Ruthenium	Ru	44	101.7
Samarium	Sm	62	150.43
Scandium	Sc	21	45.10
Selenium	Se	34	78.96
Silicon	Si	14	28.06
Silver	Ag	47	107.880
Sodium	Na	11	22.997
Strontium	Sr	38	87.63
Sulfur	S	16	32.06
Tantalum	Ta	73	180.88
Tellurium	Te	52	127.61
Terbium	Tb	65	159.2
Thallium	Tl	81	204.39
Thorium	Th	90	232.12
Thulium	Tm	69	169.4
Tin	Sn	50	118.70
Titanium	Ti	22	47.90
Tungsten	W	74	183.92
Uranium	U	92	238.07
Vanadium	V	23	50.95
Virginium†	Vi	87	224
Xenon	Xe	54	131.3
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.92
Zinc	Zn	30	65.38
Zirconium	Zr	40	91.22

†Data not as yet established by International Committee on Atomic Weights.

Elements 43, 85 and 87 are also called, respectively, Technetium (Tc), Astatine (A+) and Francium (Fy).

*Report of International Committee on Atomic Weights, *J. Am. Chem. Soc., 63,850* (1941).

DENSITY DATA FOR LEAD, TIN AND THEIR ALLOYS

Metal	Density (Water—1)	Wt. in Lbs. per Cu. In.	Wt. in Lbs. per Cu. Ft.
Lead	11.36	.410	708
Tin	7.30	.264	453
5% Tin 95% Lead	11.00	.397	686
10% Tin 90% Lead	10.70	.386	667
25% Tin 75% Lead	9.95	.359	620
30% Tin 70% Lead	9.70	.350	605
35% Tin 65% Lead	9.50	.343	593
40% Tin 60% Lead	9.30	.336	581
45% Tin 55% Lead	9.10	.328	567
50% Tin 50% Lead	8.89	.321	555
55% Tin 45% Lead	8.70	.314	542
60% Tin 40% Lead	8.50	.3058	528
6% Antimony 94% Lead	10.88	.392	679
8% Antimony 92% Lead	10.74	.388	674
10% Antimony 90% Lead	10.59	.382	664
12% Antimony 88% Lead	10.52	.380	655

SPECIFIC GRAVITY DEGREES BAUME TABLE

For Three Common Acid Solutions

Phosphoric Acid % H_3PO_4	Specific Gravity	°Baumé
1	1.0038	0.6
10	1.0532	7.3
20	1.1134	14.8
30	1.1805	22.2
40	1.254	29.4
50	1.335	36.4
60	1.426	43.3
70	1.526	50.0
80	1.633	56.2
90	1.746	62.0
100	1.870	67.5

Zinc Chloride % $ZnCl_2$	Specific Gravity	°Baumé
2	1.0167	2.4
10	1.0819	11.0
20	1.1866	22.8
30	1.2928	32.8
40	1.4173	42.7
50	1.5681	52.5
60	1.749	62.1
70	1.962	71.1

Sulphuric Acid % H_2SO_4	Specific Gravity	°Baumé
1	1.0051	0.7
10	1.0661	9.0
20	1.1394	17.7
30	1.2185	26.0
40	1.3028	33.7
50	1.3951	41.1
60	1.4983	48.2
70	1.6105	55.0
80	1.7272	61.1
90	1.8144	65.1
97	1.8364	66.0
100	1.8305	65.8

Approximate boiling points of H_2SO_4 at atmospheric pressure

50 °Bé—295 F
60 " —386 F
61 " —400 F
62 " —415 F
63 " —432 F
64 " —451 F
65 " —485 F
66 " —538 F

COMPARISON OF BAUME SCALE AND SPECIFIC GRAVITY

Liquids Heavier Than Water[1]

Degrees Baumé	Specific Gravity	Pounds per Gallon
0	1.000	8.328
5	1.036	8.625
10	1.074	8.945
15	1.115	9.289
20	1.160	9.660
25	1.208	10.063
30	1.261	10.501
35	1.318	10.978
40	1.381	11.501
45	1.450	12.076
50	1.526	12.711
55	1.611	13.417
60	1.706	14.207
65	1.813	15.094
66	1.835	15.285

[1]Degrees Baumé $= 145 - \frac{145}{\text{sp. gr.}}$

CONVERTING METERS TO FEET

Meters	Foot Equivalent	Meters	Foot Equivalent
1	3.2808	26	85.3008
2	6.5616	27	88.5816
3	9.8424	28	91.8624
4	13.1232	29	95.1432
5	16.4040	30	98.4240
6	19.6848	31	101.7048
7	22.9656	32	104.9856
8	26.2464	33	108.2664
9	29.5272	34	111.5472
10	32.8080	35	114.8280
11	36.0888	36	118.1088
12	39.3696	37	121.3896
13	42.6504	38	124.6704
14	45.9312	39	128.0512
15	49.2120	40	131.2320
16	52.4928	41	134.5128
17	55.7736	42	137.7936
18	59.0544	43	141.0744
19	62.3352	44	144.3552
20	65.6160	45	147.6360
21	68.8968	46	150.9168
22	72.1776	47	154.1976
23	75.4584	48	157.4784
24	78.7392	49	160.7592
25	82.0200	50	164.0400

PHYSICAL PROPERTIES OF LEAD

Atomic number	82
Atomic weight	207.21
Density—20°C., cast	11.35
327.4°C., solid	11.005
327.4°C., liquid	10.686
550°C., liquid	10.418
Atomic volume	18.27
Melting point, °C.	327.4
Boiling point °C., at 760 mm. pressure	1700
Specific heat, per °C., cal per g.	0.030
Latent heat of fusion, cal per g.	5.47-6.26
Coef. of linear expansion (17-100°C.), per °C.	0.0000293
Thermal conductivity, cal./cm.^{2}/cm./°C./sec. at room temperature	0.083
Electrical resistivity, microhm/cm.	20.65
Modulus of elasticity in tension	0.8-2.0 million

PHYSICAL PROPERTIES OF TIN

Atomic number	50
Atomic weight	118.7
Density—20°C., cast	7.29
Atomic volume	16.23
Melting point, °C.	232
Boiling point °C., at 760 mm. pressure	2270
Specific heat, per °C., cal per g.	0.054
Latent heat of fusion, cal per g.	14.4
Coef. of linear expansion (17-100°C.), per °C.	0.000023
Thermal conductivity, cal./cm.^{2}/cm./°C./sec. at room temperature	0.157
Electrical resistivity, microhm/cm	11.5
Modulus of elasticity in tension	5.9-7.8 million

PHYSICAL PROPERTIES OF ZINC

Atomic number	30
Atomic weight	65.38
Density—20°C., cast	7.14
Melting point °C.	419.4
Boiling point °C., at 760 mm pressure	907
Coef. of linear expansion (17-100°C.), per°C	0.000033
Thermal conductivity, cal./cm.^{2}/cm./°C./sec.	0.268
Electrical resistivity, microhm/cm	6.0
Color	Bluish White
Character	Brittle at ordinary temperatures Malleable at 100°C. (212°F.)

PHYSICAL PROPERTIES OF ANTIMONY

Atomic number	51
Atomic weight	121.76
Density	6.62
Melting point °C.	630
Boiling point °C., at 760 mm pressure	1440
Coef. of linear expansion (17-100°C.), per °C.	0.0000113
Thermal conductivity, cal./cm.^{2}/cm./°C./sec.	0.50
Electrical resistivity, microhm/cm.	2.67
Color	Blue-white
Character	Brittle

PHYSICAL PROPERTIES OF COPPER

Atomic number	29
Atomic weight	63.57
Density—20°C.	8.94
Melting point, °C.	1083
Boiling point, °C. at 760 mm. pressure	2595
Coef. of linear expansion (17-100°C), per°C	0.0000164
Specific heat, per °C., cal. per g.	0.0919
Latent heat of fusion, cal. per g.	50.46
Electrical resistivity, microhm/cm.	1.682
Thermal conductivity, cal./cm.²/cm./sec./°C.	0.923

PHYSICAL PROPERTIES OF OTHER METALS

Metal and Chemical Symbol	Density	Wt. Lbs. Per Cu. In.	Coefficient of Linear Expansion per °F. at Room Temperature	Melting Points		Boiling Points at 760 mm. Pressure	
				°Fahr.	°Cent.	°Fahr.	°Cent.
Aluminum, pure (Al)	2.70	.0975	.0000133	1215	652	2733	1500
Arsenic (As)	5.73	.2070	.00000214	*1497	*814	*1139	*615
Bismuth (Bi)	9.80	.3541	.00000747	520	271	2642	1450
Brass, (67 Cu, 33 Zn	8.47	.3060	.0000106	1670-1706	910-930	....	....
Brass, (80 Cu, 20 Zn)	8.62	.3113	.0000100	1769-1814	965-990	....	....
Cadmium, cast (Cd)	8.65	.3125	.0000166	610	321	1413	767
Calcium (Ca)	1.55	.0560	.0000139	1564	851	2709	1487
Chromium (Cr)	7.148	.2579	.0000045	2822	1550	4500	2482
Cobalt (Co)	8.9	.3216	.0000067	2714	1490	5252	2900
Gold, pure, cast (Au)	19.3	.6973	.0000080	1945	1063	5371	2966
Iridium (Ir)	22.4	.809	.0000035	4368	2409	8852	4900
Iron, pure (Fe)	7.87	.284	.0000066	2795	1535	5430	3000
Iron, cast, 4% Carbon	7.03	.2538	.0000066	2102	1150	....	....
Magnesium (Mg)	1.74	.0628	.0000143	1204	651	2025	1107
Manganese (Mn)	7.44	.268	.0000128	2268	1242	3904	2151
Mercury (Hg)	13.546	.489	.....	−38.0	−39	674	357
Nickel, cast (Ni)	8.9	.322	.0000076	2645	1452	5252	2900
Platinum (Pt)	21.45	.774	.0000043	3224	1773	7933	4390
Potassium (K)	0.86	.031	.000046	144.1	62	1425	774
Silver, pure (Ag)	10.5	.38	.0000105	1761	960	3634	2001
Sodium (Na)	0.97	.035	.0000395	207.5	97.5	1638	892
Steel, soft, .1% Carbon	7.87	.2843	.0000066	2732-2804	1500-1540	5430	3000
Tellurium (Te)	6.24	.224	.0000093	846	452	1989	1087
Titanium (Ti)	4.5	.163	.00000396	3272	1800	9212	5100
Tungsten (W)	19.3	.698	.0000022	6098	3370	10700	5927

*Under pressure. Sublimes without melting at ordinary pressure.

THERMAL DATA FOR COMMON METALS AND ALLOYS*

Metal	Mean Specific Heat 60°F. to M.P., B.t.u. per Lb. per °F.	Heat in Solid at Melting Temp., B.t.u. per Lb.	Latent Heat of Fusion, B.t.u. per Lb.	Total Heat in Liquid at Melting Temp., B.t.u. per Lb.	Mean Specific Heat of Liquid B.t.u. per Lb. per °F.	Average Pouring Temperature °F.	Total Heat in Liquid at Pouring Temp., B.t.u. per Lb.
Aluminum	0.248	286.4	169.1	455.5	0.252	1380	497.1
Antimony	0.054	59.7	70.0	129.7	0.054	1320	138.0
Bismuth	0.033	15.1	18.5	33.6	0.035	620	37.2
Cadmium	0.058	37.4	19.5	56.9	0.074	750	67.3
Copper	0.104	199.9	90.8	290.7	0.111	2200	314.9
Lead	0.032	18.0	9.9	27.9	0.032	720	31.1
Tin	0.069	26.9	24.9	51.8	0.060	650	63.8
Zinc†	0.101	73.	44.	117.	0.122	900	131.
Alloys	**Composition**						
Babbitt							
Lead Base:	75 Pb, 15 Sb, 10 Sn	0.039	15.8	26.2	42.0	0.038	625	48.2
Tin Base:	83.3 Sn, 8.4 Sb, 8.3 Cu	0.071	28.6	34.1	62.7	0.063	916	91.2
Die Casting							
Zinc Base:	95.86 Zn, 4.1 Al, 0.04 Mg†	0.105	69.	49.	118.	0.127	770	131.
Tin Base:	90 Sn, 4.5 Cu, 5.5 Sb	0.070	27.6	30.3	57.9	0.062	650	70.3
Lead Base:	80 Pb, 10 Sn, 10 Sb	0.038	20.5	17.4	37.9	0.037	820	46.0
Aluminum:	92 Al, 8 Cu	0.236	257.3	163.1	420.4	0.241	1400	480.8
Linotype:	86 Pb, 11 Sb, 3 Sn	0.036	15.3	21.5	36.8	0.036	620	41.6
Low Melting Point Metals†							
Lipowitz:	26 Pb, 13 Sn, 10 Cd, 51 Bi	0.041	3.6	12.	15.6	0.041	190	17.2
Wood's:	26 Pb, 13 Sn, 12 Cd, 49 Bi	0.041	3.6	12.	15.6	0.042	190	17.2
Rose's:	28 Pb, 22 Sn, 50 Bi	0.043	6.1	13.	19.1	0.041	330	23.8
Plumbers' Solder:	50 Pb, 50 Sn	0.051	18.1	23.0	41.1	0.046	500	45.1
Stereotype:	82 Pb, 15 Sb, 3 Sn	0.036	15.5	26.2	41.7	0.036	620	46.4

*From Industrial Gas Series, "Combustion" 3rd Edition, Am. Gas Assn. †Data revised by National Lead Company.

PHYSICAL PROPERTIES OF CAST LEAD-ANTIMONY ALLOYS

Antimony %	Liquidus °F.	Brinell Hardness No.	Density	Tensile Strength Lbs. per Sq. In.	Elongation %
0	621	4.0	11.35	1780	80
1	612	7.0	11.26	3400	16
2	602	8.0	11.18	4200	16
3	590	9.1	11.10	4700	15
4	578	10.1	11.03	5660	22
5	565	11.0	10.95	6360	29
6	552	11.8	10.88	6840	24
7	539	12.5	10.81	7180	21
8	527	13.3	10.74	7420	19
9	515	14.0	10.66	7580	17
10	505	14.6	10.59	7670	15
11	496	14.8	10.52	7620	13
12	489	15.0	10.45	7480	12
12.5	485	15.1	10.42	7380	11
13	492	15.2	10.38	7280	10
14	496	15.3	10.30	7000	9

TABLE OF DECIMAL EQUIVALENTS

Fraction	Decimal	Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
1/64	.015625	17/64	.265625	33/64	.515625	49/64	.765625
1/32	.03125	9/32	.28125	17/32	.53125	25/32	.78125
3/64	.046875	19/64	.296875	35/64	.546875	51/64	.796875
1/16	.0625	5/16	.3125	9/16	.5625	13/16	.8125
5/64	.078125	21/64	.328125	37/64	.578125	53/64	.828125
3/32	.09375	11/32	.34375	19/32	.59375	27/32	.84375
7/64	.109375	23/64	.359375	39/64	.609375	55/64	.859375
1/8	.125	3/8	.375	5/8	.625	7/8	.875
9/64	.140625	25/64	390625	41/64	.640625	57/64	.890625
5/32	.15625	13/32	.40625	21/32	.65625	29/32	.90625
11/64	.171875	27/64	.421875	43/64	.671875	59/64	.921875
3/16	.1875	7/16	.4375	11/16	.6875	15/16	.9375
13/64	.203125	29/64	.453125	45/64	.703125	61/64	.953125
7/32	.21875	15/32	.46875	23/32	.71875	31/32	.96875
15/64	.234375	31/64	.484375	47/64	.734375	63/64	.984375
1/4	.25	1/2	.5	3/4	.75	1	1.

TABLE OF DECIMAL EQUIVALENTS—OUNCES AND POUNDS

Ounces	Pounds	Ounces	Pounds	Ounces	Pounds	Ounces	Pounds	Ounces	Pounds
1/4	= .015625	2 1/2	= .15625	5 1/2	= .3438	8 1/2	= .5313	14	= .875
1/2	= .03125	3	= .1875	6	= .375	9	= .5625	15	= .9375
3/4	= .046875	3 1/2	= .21875	6 1/2	= .4063	10	= .625	16	= 1.
1	= .0625	4	= .25	7	= .4375	11	= .6875		
1 1/2	= .09375	4 1/2	= .2813	7 1/2	= .4688	12	= .75		
2	= .125	5	= .3125	8	= .5	13	= .8125		

COMPARISON OF GAUGES

No.	Birmingham or Stubs	American or Brown & Sharpe	United States Standard	No.	Birmingham or Stubs	American or Brown & Sharpe	United States Standard
.....	....	....	....	16	.065	.05082	.0625
.....	....	....	....	17	.058	.04525	.05625
.....	....	....	....	18	.049	.04030	.05
0000000	....	....	.5	19	.042	.03589	.04375
000000	....	....	.46875	20	.035	.03196	.0375
00000	....	....	.4375	21	.0315	.02846	.034375
0000	.454	.460	.40625	22	.028	.025347	.03125
000	.425	.40964	.375	23	.025	.022571	.028125
00	.380	.3648	.34375	24	.022	.0201	.025
0	.340	.32486	.3125	25	.020	.0179	.021875
1	.300	.28930	.28125	26	.018	.01594	.01875
2	.284	.25763	.265625	27	.016	.014195	.0171875
3	.259	.22942	.25	28	.014	.012641	.015625
4	.238	.20431	.234375	29	.013	.011257	.0140625
5	.220	.18194	.21875	30	.012	.010025	.0125
6	.203	.16202	.203125	31	.010	.008928	.0109375
7	.180	.14428	.1875	32	.009	.00795	.01015625
8	.165	.12849	.171875	33	.008	.00708	.009375
9	.148	.11443	.15625	34	.007	.00603	.00859375
10	.134	.10189	.140625	35	.005	.00561	.0078125
11	.120	.09074	.125	36	.004	.005	.00703125
12	.109	.08081	.109375	37	....	.00445	.006640625
13	.095	.07196	.09375	38	....	.003965	00625
14	.083	.06408	.078125	39	....	.003531	.....
15	.072	.05707	.0703125	40	....	.003144	.....

MENSURATION

TO OBTAIN	MULTIPLY	BY
ANNULUS		
Area of	Diff. of sq. of diam.	0.78540
"	Diff. of sq. of radii	3.1416
CIRCLE		
Area of	Circum.	$\frac{1}{2}$×radius
"	Circum.	$\frac{1}{4}$×diameter
"	Circum.^{2}	0.0795
"	Diameter^2	0.7854
"	Radius^2	3.1416
Circum. of	Diameter	3.1416
"	Radius	6.2832
Diam. of	Circum.	0.3183
Radius of	Circum.	0.1591
Side of equal square of	Circum. of circle	0.2821
"	Diam. of circle	0.8861
Side of inscribed equal. triangle of	Diam. of circle	0.8660
Side of inscribed square of	Circum. of circle	0.2251
Side of inscribed square of	Diam. of circle	0.7071
CONE, REGULAR		
Volume of	Area of base	$\frac{1}{3}$×altitude
CONE, RIGHT CIRCULAR		
Lateral area of	Radius of base	3.1416×slant height
Volume of	(Radius of base)^2	1.0472×altitude
CUBE		
Diagonal of	Length of one side	1.7321
Total surface area of	Area of one side	6
Volume of	Area of one side	Length of one side
"	(Length of one side)^3	1
CYCLOID		
Area of	(Radius of circle)^2	9.4248
Length of arc of	Radius of circle	8
CYLINDER, HOLLOW		
External surface area of	External radius	6.2832×height
Internal surface area of	Internal radius	6.2832×height
Volume of	Diff. of sq. of radii	3.1416×height
CYLINDER, TRUNCATED RIGHT CIRCULAR		
Lateral area of	Perimeter of base	Average height
Volume of	Area of base	Average height
ELLIPSE		
Area of	Product of axes	0.7854
"	Product of semi-axes	3.1416
FILLET		
Area of	(Radius of circle)^2	0.2146
PARABOLA		
Area of section of	Max. width of section	$\frac{2}{3}$×length of cord
PARALLELOGRAM		
Area of	Length of base	Altitude
PRISM, RECTANGULAR		
Volume of	Area of base	Altitude
PRISM, REGULAR		
Lateral area of	Perimeter of base	Altitude
Volume of	Area of base	Altitude
PYRAMID, REGULAR		
Lateral area of	Perimeter of base	$\frac{1}{2}$×slant height
Volume of	Area of base	$\frac{1}{3}$×altitude
RECTANGLE		
Area of	Length of base	Altitude
RHOMBUS		
Area of	Product of diagonals	$\frac{1}{2}$
SECTOR		
Area of	Length of arc	$\frac{1}{2}$×radius
SPHERE		
Side of inscribed cube of	Radius	1.1547
Surface of	Circum.	Diameter
"	Diameter^2	3.1416
Volume of	Circum.^{3}	0.0169
"	Diameter^3	0.5236
"	Radius^3	0.4188
"	Surface	$\frac{1}{6}$×diameter
Volume of inscribed cube of	Radius^3	1.5395
TRAPEZOID		
Area of	Sum of parallel sides	$\frac{1}{2}$×altitude
TRIANGLE		
Area of	Length of base	$\frac{1}{2}$×altitude

TEMPERATURE CONVERSION

TO CONVERT FROM	TO	SUBSTITUTE IN FORMULA
Degrees Centigrade	Degrees Fahrenheit	(°C.×9/5)+32
Degrees Centigrade	Degrees Absolute*	(°C.+273.18)
Degrees Centigrade	Degrees Reaumur	(°C.×4/5)
Degrees Fahrenheit	Degrees Centigrade	(°F.−32)×5/9
Degrees Fahrenheit	Degrees Reaumur	(°F.−32)×4/9
Degrees Reaumur	Degrees Centigrade	(°Reaumur×5/4)
Degrees Reaumur	Degrees Fahrenheit	(°Reaumur×9/4)+32

*or Kelvin or Rankin

PREFIXES

PREFIX	MEANING	NUMERICAL VALUE	
Micromicro-	One-trillionth	0.000,000,000,001	or 10^{-12}
Millimicro-	One-billionth	0.000,000,001	10^{-9}
Micro-	One-millionth	0.000,001	10^{-6}
Milli-	One-thousandth	0.001	10^{-3}
Centi-	One-hundredth	0.01	10^{-2}
Deci-	One-tenth	0.1	10^{-1}
Deka-	Ten	10	10
Hecto-	One hundred	100	10^{2}
Kilo-	One thousand	1,000	10^{3}
Mega-	One million	1,000,000	10^{6}

DIAMETERS, CIRCUMFERENCES AND AREAS OF CIRCLES IN INCHES

including contents in gallons at one foot in depth.

Diameter Inches	Circum. Inches	Area Sq. Ins.	Gallons 1 Ft. Depth
1 in.	3.1416	.7854	.04084
1/8	3.5343	.9940	.05169
1/4	3.9270	1.2271	.06380
3/8	4.3197	1.4848	.07717
1/2	4.7124	1.7671	.09188
5/8	5.1051	2.0739	.10784
3/4	5.4978	2.4052	.12506
7/8	5.8905	2.7611	.14357
2 in.	6.2832	3.1416	.16333
1/8	6.6759	3.5465	.18439
1/4	7.0686	3.9760	.20675
3/8	7.4613	4.4302	.23036
1/2	7.8540	4.9087	.25522
5/8	8.2467	5.4119	.28142
3/4	8.6394	5.9395	.30883
7/8	9.0321	6.4918	.33753
3 in.	9.4248	7.0686	.36754
1/8	9.8175	7.6699	.39879
1/4	10.210	8.2957	.43134
3/8	10.602	8.9462	.46519
1/2	10.995	9.6211	.50029
5/8	11.388	10.320	.53664
3/4	11.781	11.044	.57429
7/8	12.173	11.793	.61324
4 in.	12.566	12.566	.65343
1/8	12.959	13.364	.69493
1/4	13.351	14.186	.73767
3/8	13.744	15.033	.78172
1/2	14.137	15.904	.82701
5/8	14.529	16.800	.87360
3/4	14.922	17.720	.92144
7/8	15.315	18.665	.97058
5 in.	15.708	19.635	1.02102
1/8	16.100	20.629	1.07271
1/4	16.493	21.647	1.12564
3/8	16.886	22.690	1.17988
1/2	17.278	23.758	1.23542
5/8	17.671	24.850	1.29220
3/4	18.064	25.967	1.35028
7/8	18.457	27.108	1.40962
6 in.	18.849	28.274	1.47025
1/8	19.242	29.464	1.53213
1/4	19.635	30.679	1.59531
3/8	20.027	31.919	1.65979

Diameter Inches	Circum Inches	Area Sq. Ins.	Gallons 1 Ft. Depth
6 1/2	20.420	33.183	1.72552
5/8	20.813	34.471	1.79249
3/4	21.205	35.784	1.86077
7/8	21.598	37.122	1.93034
7 in.	21.991	38.484	2.00117
1/8	22.383	39.871	2.07329
1/4	22.776	41.282	2.14666
3/8	23.169	42.718	2.22134
1/2	23.562	44.178	2.29726
5/8	23.954	45.663	2.37448
3/4	24.347	47.173	2.45299
7/8	24.740	48.707	2.53276
8 in.	25.132	50.265	2.61378
1/8	25.515	51.848	2.69609
1/4	25.918	53.456	2.77971
3/8	26.310	55.088	2.86458
1/2	26.703	56.745	2.95074
5/8	27.096	58.426	3.03815
3/4	27.489	60.132	3.12686
7/8	27.881	61.862	3.21682
9 in.	28.274	63.617	3.30408
1/8	28.667	65.396	3.40059
1/4	29.059	67.200	3.49440
3/8	29.452	69.029	3.58951
1/2	29.845	70.882	3.68586
5/8	30.237	72.759	3.78347
3/4	30.630	74.662	3.88242
7/8	31.023	76.588	3.98258
10 in.	31.416	78.540	4.08408
1/8	31.808	80.515	4.18678
1/4	32.201	82.516	4.29083
3/8	32.594	84.540	4.39608
1/2	32.986	86.590	4.50268
5/8	33.379	88.664	4.61053
3/4	33.772	90.762	4.71962
7/8	34.164	92.885	4.82846
11 in.	34.557	95.033	4.94172
1/8	34.950	97.205	5.05466
1/4	35.343	99.402	5.16890
3/8	35.735	101.623	5.28439
1/2	36.128	103.869	5.40119
5/8	36.521	106.139	5.51923
3/4	36.913	108.434	5.63857
7/8	37.306	110.753	5.75916

These tables are theoretically correct, but variations must be expected in practice.

DIAMETERS, CIRCUMFERENCES AND AREAS OF CIRCLES IN FEET

including contents in gallons at one foot in depth.

Diameter Ft. In.	Circum. Ft. In.	Area Sq. Ft.	Gallons 1 Ft. Depth	Diameter Ft. In.	Circum. Ft. In.	Area Sq. Ft.	Gallons 1 Ft. Depth
1	3 1⅝	.7854	5.8735	4 8	14 7⅞	17.1041	127.9112
1 1	3 4⅜	.9217	6.8928	4 9	14 11	17.7205	132.5209
1 2	3 8	1.0690	7.9944	4 10	15 2⅛	18.3476	137.2105
1 3	3 11	1.2271	9.1766	4 11	15 5¼	18.9858	142.0582
1 4	4 2⅛	1.3962	10.4413	5	15 8½	19.6350	146.8384
1 5	4 5⅜	1.5761	11.7866	5 1	15 11⅝	20.2947	151.7718
1 6	4 8½	1.7671	13.2150	5 2	16 2¾	20.9656	156.7891
1 7	4 11⅝	1.9689	14.7241	5 3	16 5¾	21.6475	161.8886
1 8	5 2¾	2.1816	16.3148	5 4	16 9	22.3400	167.0674
1 9	5 5⅞	2.4052	17.9870	5 5	17 0⅛	23.0437	172.3300
1 10	5 9	2.6398	19.7414	5 6	17 3¼	23.7583	177.6740
1 11	6 2¼	2.8852	21.4830	5 7	17 6⅜	24.4835	183.0973
2	6 3⅜	3.1416	23.4940	5 8	17 9⅝	25.2199	188.6045
2 1	6 6½	3.4087	25.4916	5 9	18 0¾	25.9672	194.1930
2 2	6 9⅝	3.6869	27.5720	5 10	18 3⅞	26.7251	199.8610
2 3	7 0¾	3.9760	29.7340	5 11	18 7⅛	27.4943	205.6133
2 4	7 3⅞	4.2760	32.6976	6	18 10⅛	28.2744	211.4472
2 5	7 7	4.5869	34.3027	6 3	19 7½	30.6796	229.4342
2 6	7 10¼	4.9087	36.7092	6 6	20 4⅞	33.1831	248.1564
2 7	8 1⅜	5.2413	39.1964	6 9	21 2⅜	35.7847	267.6122
2 8	8 4½	5.5850	41.7668	7	21 11⅞	38.4846	287.8230
2 9	8 7⅝	5.9395	44.4179	7 3	22 9¼	41.2825	308.7270
2 10	8 10¾	6.3049	47.1505	7 6	23 6¾	44.1787	330.3859
2 11	9 1⅞	6.6813	49.9654	7 9	24 4⅛	47.1730	352.7665
3	9 5	7.0686	52.8618	8	25 1½	50.2656	375.9062
3 1	9 8¼	7.4666	55.8382	8 3	25 11	53.4562	399.7668
3 2	9 11⅜	7.8757	58.8976	8 6	26 8⅜	56.7451	424.3625
3 3	10 2½	8.2957	62.0386	8 9	27 5¾	60.1321	449.2118
3 4	10 5⅝	8.7265	65.2602	9	28 3¼	63.6174	475.7563
3 5	10 8¾	9.1683	68.5193	9 3	29 0⅝	67.2007	502.5536
3 6	10 11⅞	9.6211	73.1504	9 6	29 10⅛	70.8823	530.0861
3 7	11 3	10.0846	75.4166	9 9	30 7½	74.6620	558.3522
3 8	11 6⅛	10.5591	78.9652	10	31 5	78.5400	587.3534
3 9	11 9⅜	11.0446	82.5959	10 3	32 2⅜	82.5160	617.0876
3 10	12 0½	11.5409	86.3074	10 6	32 11¾	86.5903	647.5568
3 11	12 3⅝	12.0481	90.1004	10 9	33 9¼	90.7627	678.2797
4	12 6¾	12.5664	93.9754	11	34 6⅝	95.0334	710.6977
4 1	12 9⅞	13.0952	97.9310	11 3	35 4⅛	99.4021	743.3686
4 2	13 1	13.6353	101.9701	11 6	36 1½	103.8691	776.7746
4 3	13 4⅛	14.1862	103.0300	11 9	36 10⅞	108.4342	810.9143
4 4	13 7¼	14.7479	110.2907	12	37 8⅜	113.0976	848.1890
4 5	13 10½	15.3206	114.5735	12 3	38 5¾	117.8590	881.3966
4 6	14 1⅜	15.9043	118.9386	12 6	39 3¼	122.7187	917.7395
4 7	14 4⅝	16.4986	123.3830	12 9	40 0⅝	127.6765	954.8159

These tables are theoretically correct, but variations must be expected in practice.

PRODUCTS OF NATIONAL LEAD COMPANY

PRODUCTS OF THE METAL DIVISION

SHEET LEAD

Antimonial
Chemical
Common
Crawlproof
Tellurium
Tellurium-Antimonial
Special Alloy

LEAD PIPE

Antimonial
Chemical
Common
Tellurium
Tellurium-Antimonial
Special Alloy

FITTINGS, PUMPS, VALVES

Bends, Lead or Lead Alloy
Bends and Ferrules, Combination
Cocks, Antimonial Lead Plug
Ferrules, Combination
Fittings, Cast Antimonial Lead
Flanges, Closet Floor, Hard Lead
Pumps, Antimonial Lead
Soldering Nipples, Combination
Traps, Lead or Lead Alloy
Valves, Antimonial Lead

LINED OR COVERED PRODUCTS

Acid Recovery Equipment
Bars, Lead-Covered Steel
Chemical Apparatus, Lead-Lined
Coils, Lead-Lined Copper
- Lead-Covered Copper
- Tin-Lined Copper
- Tin-Covered Copper

Fittings, Lead- or Tin-Lined
Impellers, Lead- or Tin-Covered
Pipe, Lead-Lined Iron, Brass, Copper or Steel
- Lead-Covered Iron, Brass, Copper or Steel
- Tin-Lined Iron, Brass, Copper or Steel
- Tin-Covered Iron, Brass, Copper or Steel
- Tin-Lined Lead

Pumps, Tin-Lined Lead
Sheets, Lead-Covered Steel
Tank Cars, Lead-Lined
Tank Connections, Lead- or Tin-Lined or Covered
Tanks, Lead- or Tin-Lined
Valves, Lead- or Tin-Lined
Wire, Lead-Covered Iron, Copper or Monel

BEARING METAL

Dutch Boy and Hoyt Brands
Special Shapes
Special Composition

SOLDER

Dutch Boy Brands
Rosin and Acid Core
Solder Fluxes
Solder Paints
Special Shapes
Special Composition

CINCH ANCHORING SYSTEM

Expansion Bolts

BLATCHFORD PLATE MOUNTING SYSTEM

HOMOGENEOUS LEAD EQUIPMENT

See Lined or Covered Products

TYPE METALS

Combination Metal
Linotype—Intertype
Ludlow
Monotype
Sorts Caster
Stereotype—Autoplate
Special Mixtures

MISCELLANEOUS PRODUCTS

Alloys, Lead, Tin or Zinc Base
Aluminum Solder
Anodes, Lead, Tin or Special Alloy
Antimony
Antimonial Lead
Balls, Lead
Bars, Lead or Tin
Battery Straps
Bearings
Bearing Plates, Lead
Bottles, Lead
Britannia Metal
Burning Bar
Came Lead
Castings, Special
Caulking Lead
Chemical Lead
C. T. Metal
Coils, Lead, Tin or Special Alloy
Common Lead
Electrotype Cases
Electrotype Metal
Extruded Shapes, Special
Flux, Blatchford
Flux, Solder
Fuse Wire
Gaskets, Lead
Gasket Metal
Glazier's Lead
Grid Metal
Guards, Metal
Hammer Metal
Hammers, Lead or Babbitt
Hardening Lead
Impression Lead
Ingot Lead
Key Leads
Kirksite A
Leads, Printers
Mold Metal, Rubber
Music Plates
Needle Metal
Net Leads
Organ Pipe Metal
Ornaments, Lead
Pewter
Phosphor Tin
Pig Lead
Pig Tin
Pinking Blocks
Pipe, Tin
Plates, Lead
Pulverized Metals
Ribbon, Tin or Lead
Roof Flanges
Roofing Washers
Sash Weights, Lead
Screens, Lead
Sheet Tin
Shredded Lead
Sinkers, Lead
Sleeving, Lead
Shot, Lead
Sounding Leads
Spacers, Lead
Spelter
Stamping Metal
Tellurium Lead
Tellurium-Antimonial Lead
Tempering Lead
Tinning Compound
Tint Plates
Tube Blanks
Tubing, Lead, Tin or Special Alloy
Washers, Lead
Wedge Lead
Weights, Miscellaneous Lead
White Copper Stamping Metal
Wire, Lead, Tin or Special Alloy
Wool, Lead
Zinc
Zinc Base Alloys

OTHER PRODUCTS

Acetate of Lead
Barium Sulphate
Barytes
Basic Lead Chromate
Basic Lead Sulphate
Castor Oil
Colors, Dry and in Oil
Drier, Liquid
Drilling Muds (Oil Well)
Flake White
Flatting Oil
Flaxseed, Ground, Meal or Cake
Hyposulphite of Lead
Lead Mixing Oil
Linseed Cake
Linseed Oil
Litharge
Liquid Lead
Orange Mineral
Red-Lead
Red-Lead Paint
Titanium Pigments
Wall Primer
White-Lead

INDEX

KEY TO INDEX—The material in this catalog is divided into eighteen sections. Except for the Introduction, the sections are identified by letters which appear at the top of every page near the outer corner. The sections are in alphabetical order.

Products and other items are indexed by letters and numbers. The letters indicate the sections. The number indicates the page in the section.

INDEX (Continued)

NATIONAL LEAD COMPANY

PRODUCTS